Why do firms hire so few top skilled workers? A model of knowledge transfer within firms

Aurora Amélia Castro Teixeira (ateixeira@fep.up.pt)
CEMPRE,[♣] Faculdade de Economia, Universidade do Porto
Rua Dr. Roberto Frias, 4200-464 Porto Portugal

Pedro Cosme da Costa Vieira (pcosme@fep.up.pt)
Faculdade de Economia, Universidade do Porto
R. Dr. Roberto Frias, 4200-464 Porto Portugal

Abstract

An unquestionable theoretical argument is that a worker with high level of human capital, i.e. skilled, is not less productive than his/her low-level counterpart. In spite of this, employment figures often show that firms prefer low skilled workers. This stylised fact seems, at first glance, to translate non-optimum firm behaviour. Employers, however, argue that when workers are high skilled, they rapidly absorb firm's transferable knowledge; in order to prevent the exit of such workers, which would danger firm fitness, employers are obliged to increase their wages. To validate this argument, we propose a theoretical model with microeconomic foundations that is reduced into a *logit* hazard function. Data used includes around 1400 firms, spanning 1984-1992. The estimation of the theoretical model enables to legitimate employers' argument. Therefore, if fostering top skilled employment is a policy goal, labour laws should allow employers to hire workers in a long-term contractual basis, granting employers compensation rights in the event workers exit for a rival firm.

Keywords: Knowledge transfer, Skills, Evolutionary theory; *Hazard* function; Portuguese Textiles

[♣] CEMPRE - Centro de Estudos Macroeconómicos e Previsão - is supported by the Fundação para a Ciência e a Tecnologia, Portugal, through the Programa Operacional Ciência, Tecnologia e Inovação (POCTI) of the Quadro Comunitário de Apoio III, which is financed by FEDER and Portuguese funds.

1. Introduction

In theoretical terms, it is unquestionable that workers with higher schooling (i..e., skilled) are at least as productive as workers with lower schooling (Becker, 1962). The justification for this is that during professional life the worker perform simple and routine operations whose productivity does not increase with the schooling level and perform complex and new tasks whose learning curve improves with schooling. Being so, on average, schooling has a positive effect on the expected future worker's productivity (e.g., Abramovitz, 1986; Prais, 1995).

However, according to data on Portuguese employment, the ratio between the number of potential jobs that exists in firms and the number of workers that seek employment is smaller for the workers with higher schooling than for their counterpart (Batista, 1993, 1996). Being that in last years there was an exponential increase in schooling, the relative size of the mentioned ratio evidences that firms had not adjust its top educated workers at a similar rate of increasing in the number of candidates with high schooling levels.

Information gathered from a mail survey and personal interviews (Teixeira, 2002), managers argue that hiring top educated workers increase firms failure risk. Notwithstanding the fact that the speed of learning acquisition is higher in the case of top educated workers and that this can be regarded as an advantage for the firm in the short run, their more rapid absorption of firms' pool of knowledge specific to the industry may severely endanger firm survival prospects when these workers decide to exit to other firms. Through this dynamic process, the short run advantage is diluted and in the medium or long term the firm may become "captive" of the top educated workers. This leads to increases in top skilled workers wage in an extent that turns top skilled hiring unprofitable to the firm.

In our work we intended to investigate the rationality of the argument used by firms. Thus, in the next section, we presented a theoretical model with microeconomic foundations, which is reduced into a logit econometric model (an hazard function). Later on (section 3), using unpublished data from "Quadros de Pessoal" for periods from 1984 to 1992, encompassing approximately 1400 Portuguese textile firms, we estimate the reduced form model. The "Quadros de Pessoal" is a compulsory inquiry to all Portuguese firms having at least one wage-earning worker and is unanimously recognized as accurately representing the whole population of Portuguese firms (Mata and Portugal, 1994). Finally, section 4, concludes the study pointing some policy recommendations.

2. The Model

The productivity of worker i, $y_{i},$ increases with worker's schooling level, sc_i, with worker's industry specific knowledge, isk_i, and with firm total industry specific knowledge, Isk :

$$y_i = y(sc_i, isk_i, Isk), \quad \frac{dy}{d\ sc_i} > 0, \quad \frac{dy}{d\ isk_i} > 0, \quad \frac{dy}{d\ Isk} > 0 \tag{1}$$

Firm total industry specific knowledge, Isk, results from the sum of all non-redundant knowledge that each firm worker possesses plus the knowledge possessed by the entrepreneur. Being so, each worker has a percentage α_i of this total knowledge, $\alpha_i \in [0; 1]$.

In the very instant that the worker is hired, he/she has a reserve wage computed as if, in alternative, he/she becomes an entrepreneur, being $Isk = isk_i$.

$$w_i = y(sc_i, isk_i, isk_i) \tag{2}$$

Assuming that the labor market is in perfect competition and that w_i is observable, then the worker wage will be exactly his/her reserve wage.

The benefit that a firm gets from hiring a worker, Δ_i, may be computed subtracting wages from worker productivity:

$$\Delta_i = y\left(sc_i, isk_i, Isk + (1 - \alpha i) \cdot isk_i\right) - y\left(sc_i, isk_i, isk_i\right) \tag{3}$$

Firm's benefit must have into account the fact that the newly hired worker may increase the total industry specific knowledge Isk the firm possesses.

Nonetheless, even assuming that firm's benefit increases with worker's schooling level, with time, the worker apprehends firm total industry specific knowledge (the increase in α_i is more rapid when worker schooling level is higher).

$$\dot{\alpha}_i = \dot{\alpha}(sc_i), \quad \frac{\mathrm{d}\,\dot{\alpha}(sc_i)}{\mathrm{d}\,sc_i} > 0 \tag{4}$$

Although the learning process may positively influence worker productivity, his/her reserve wage increases proportionally to increases in productivity. Therefore, if the firm does not increase worker wage he/she will exit to other firm, taking with him/her valuable knowledge, which may endanger firm surviving prospects.

$$\dot{w}_i = \left[y\left(sc_i, (\alpha_i + \dot{\alpha}_i dt) \cdot Isk, Isk\right) - y(sc_i, \alpha_i \cdot Isk, Isk)\right] / dt \tag{5}$$

In dynamic terms, firm benefit from hiring the skilled worker may increase in a first phase, but then decreases and may become even negative. This negative long-term effect happens as quicker as more educated is the worker.

Only when worker increases substantially the firm total industry specific knowledge, by a cross effect on other workers, it is unquestionably both on the short term and on the long term that it is productive hiring skilled workers.

As universities are not able to transmit this type of knowledge to students, the growth in the quantity of new workers with high level of schooling turns increasingly difficulty for these workers to find a job.

3. Empirical substantiation of the rationality of firms' argument

In order to be empirically feasible to substantiate the rationality if firms' argument, it becomes necessary to give to the theoretical model a reduced form.

Under the theoretical framework of the ecology of the populations (Hannan and Freeman, 1989), in an evolutionary process (Nelson and Winter, 1982), firms that undertake the environment suitable strategies tend to have, on average, a higher survival probability. In this way, we can reduce the theoretical model present in section 2, to a statistical relationship linking firm variation in the number of top educated workers with its survival probability.

Within a given period of time, the firm survives ($Y = 1$) or not ($Y = 0$). The survival probability in that period is conditioned on exogenous variables, Xex, on manager's decisions, Xen (which are endogenous to the model) and on parameters of the model, β.

$$P(Y = 1) = F(Xen, Xex, \beta) + \varepsilon \tag{6}$$

The manager decision is hiring, maintaining or firing top educated workers. As “Quadros de Pessoal” database does not give information on variable, we use the observed variation in the number of top educated workers as proxy for manager’s decision.

We assume, as it is standard, that firm survival function presents a *logit* distribution:

$$P(Y = 1) = \frac{1}{1 + e^{-Z}} \tag{7}$$

Re-writing the equation (7) in terms of the natural logarithm of the surviving odds against a control group, we have:

$$Ln\left(\frac{P(Y=1)}{P(Y=0)}\right)=\beta_0+\beta_1 RF+\beta_2 PF+\beta_3 IN0+\beta_3 INP+...+\varepsilon \tag{8}$$

Including several control variables (firm size; industry; etc. – further details in Teixeira, 2002), we classify firms into five groups using four dummy variables: RF - firms that in the period of analysis (1984-1988) lost their all top educated workers ('Radical Fission'); PF - firms that lost some of their top educated workers ('Partial Fission'); INP - firms that maintained all top educated workers ('Inert Positive'); IN0 - firms that have no top educated workers during the period in question ('Inert Zero'); Default group - firms that increased the number of top educated workers.

Using data for 1395 observations of the Portuguese textile industry taken from "Quadros de Pessoal", comprising the period 1984-1988 and 1988-1992, we estimated the reduced model (8).

Table 1 - Results from estimation

Variable	Definition	exp(β) estimative and (significance)
RF	Firms that lost their entire top educated workers	0.534 (0.047)
PF	Firms that lost some of their top educated workers	1.390 (0.444)
INP	Firms that maintained all top educated workers	1.030 (0.917)
IN0	Firms that have no top educated workers	0.695 (0.067)
Control	Firms that increased the number of top educated workers	1
	Control variables not presented	

From estimation output, we cannot exclude the hypothesis that the surviving probability of firms that increased the number top educated workers (the default group) is equal to the surviving probability of firms that maintained all (*INP*) or that lost some (*PF*) of their top educated workers. In the opposite, we can accept the hypothesis that the surviving probability of firms that lost all top educated workers (*RF*) is smaller than all the other group of firms.

In this way, the estimation outcome does not guarantee that, on average, in the short-term, firms see their failure risk amplified by increasing the number of top educated workers. That is, data seems not to enforce the idea that firms' argument is rational, at least in a short-term basis. On the other hand, in the long term, we may find rationality in the argumentation of firms, at least the small ones. Indeed, in general, small firms need to hire at maximum only one top educated worker; although this hiring may increase their short-term survival probability, in the medium-long term they may be exposed to a high failure risk when that top educated worker exits. In this way, in the long run, at least for small firms, it seems optimal not to hire top educated workers (*cf.* Teixeira, 2002). Notice that the survival probability of firms with no top educated workers (*IN0*) is higher than the survival probability of firms that lost all top educated workers (*RF*).

4. Conclusion

Being theoretically unquestionable that workers with higher levels of schooling are, on average, more productive than workers with lower schooling levels, firms should prefer the former. Nevertheless, in recent years, simultaneously with an exponential increase in schooling enrollment and conclusions, we observe in Portugal the puzzling preference by firms for workers with low schooling levels. Managers' justification tends to focus on the issue of fission risk. They argue that hiring top educated workers increase firm risk of failure given that these workers tend to apprehend firm total industry specific knowledge quicker than their less educated counterparts, and therefore require higher wage levels, otherwise exit to rival firms, which turn the firm unprofitable.

With the purpose of evaluating the rationality of firms' argument, we build a theoretical model with microeconomic foundations. This model was then reduced into a *logit* econometric model (an hazard function) and estimated using data from "Quadros de Pessoal".

Although the estimation results do not guarantee that, on average, firms increase the failure risk by increasing the number of top educated workers, and thus do not enforce the idea that, in the short run, firms' argument is rational. In the long run, results seem to support the idea that, at least for small firms, it is optimal not to hire top educated workers.

Therefore, if fostering top educated or skilled employment is a policy target, country's labour laws should allow employers to hire workers in a long-term contractual basis, granting them compensation rights in the event workers exit for a rival firm.

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