



Formal education versus learning-by-doing: On the labor market efficiency of educational choices[☆]



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ARTICLE INFO

Article history:

Accepted 11 January 2016

Available online xxxx

Keywords:

Formal education

Learning-by-doing

Market efficiency

On-the-job search

Search unemployment

ABSTRACT

Educational choices are studied in a two-sectors search-and-matching model where qualifications are required for access to good jobs. Qualifications can be acquired either before entering the labor market through formal education, or through learning-by-doing in a low-skill job. Spontaneously, the economy creates too many high-skill jobs and accordingly individuals devote too much effort to formal education. However, educational effort alone becomes insufficient when the rate of creation of these high-skill jobs is reduced to its optimal level. In conclusion, we show that an efficient policy would be to subsidize both education and low-skill firms whose workers quit when obtaining a job in the high-skill sector, both elements financed by a tax on high-skill firms.

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1. Introduction

Although human capital is generally measured by the amount of formal education, many skills are best learned on-the-job through participating in the production process. In the absence of learning-by-doing, workers would always hold a job equivalent to their educational level, without any prospect of improvement. The empirical literature provides a great deal of evidence that learning-by-doing is not marginal and that it should not be neglected, since it has an impact on the performance of the labor market. In this paper we develop a search and matching model of the labor market where learning-by-doing in a low-skill job and then searching (while on-the-job) for a better job is another way of reaching the same high-skill jobs held by educated workers. Individuals therefore choose their educational effort knowing that in case of failure in formal education, they would always have the opportunity to learn on-the-job in a low-skill job. When faced with this choice, workers do not choose an efficient amount of formal education. Our results could justify the introduction in several countries of educational subsidies together with a reduction in taxes on low-wage jobs.

There is significant empirical evidence on low-wage employment escape in the recent literature. For instance, using US data, [Andersson et al. \(2005\)](#) find that 15% to 20% of workers with a high school diploma or less had escaped low-wage employment after nine years. This result seems to indicate that there is a stepping-stone effect toward better

paid jobs ([Connolly and Gottschalk, 2001](#)) which is more likely to occur when workers voluntarily change jobs ([Sicherman and Galor, 1990](#), [Gottschalk, 2001](#); [Holzer, 2004](#)). Such a springboard effect is demonstrated for Germany by [Knabe and Plum \(2013\)](#) who state that the rate of transition to a high-paid job conditional on first accepting a low-paid job is particularly significant for low-skilled workers. Likewise, empirical evidence for France shows that, since the 1980s, upward professional mobility has improved, especially for low-skilled workers: 29% of blue collar workers in 1998 had experienced upward mobility between 1998 and 2003, against 19% between 1980 and 1985. We can think of a secretary becoming an executive secretary, or an unskilled worker in a routine occupation becoming skilled in a lower technical occupation in sectors such as manufacturing, industrial crafts, construction, and warehousing and transport; and then transitioning from lower to intermediate technical occupations, such as technician to foreman or supervisor ([Monso, 2006](#)). Most of those occupations could also be entered by obtaining a diploma in the relevant field of competence. This evidence is consistent with our framework, in which educated workers gain a well-paid job directly, whereas workers with a lower level of education have to train themselves on-the-job before gaining a better-paid job.

The fact remains that, during the past few decades, more and more individuals have chosen to reinforce their effort in formal education (see for instance [Machin, 1996](#), [Acemoglu, 2002](#), [Mincer, 1994, 2003](#), and [Moscarini and Vella, 2008](#)). Did these private educational choices lead to an efficient outcome? The purpose of this paper is to shed some light on this issue.

While economists have been interested in the efficiency of human capital investment for a long time (see for instance [Pigou, 1912](#) and [Becker, 1964](#)), more recent labor studies have re-examined the issue

[☆] We would like to thank Björn Brügemann, Gary Fields, and Bernd Fitzenberger for their helpful comments. The usual caveat applies.

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of educational choice in the presence of market imperfections. Our paper is a contribution to this literature, which provides some elements for judging the appropriateness of public education policy. Among other papers, Moen (1999) studies the efficiency of educational choices. Firms rank their applicants and hire the best, while workers use formal education to compete for jobs. The result is an educational effort which can be too intensive. The same result is presented by Charlot and Decreuse (2010), in which workers self-select their educational choices. Workers of low ability place too much emphasis on the value of higher formal education for gaining a job, even though education can be costly. Such inefficient behavior leads the authors to suggest that educational subsidies be prohibited. Contrariwise, Navarro (2011) concludes that too few workers choose an amount of investment in education sufficient for their being able to join the highly-productive sector. Our findings coincide with the results of the first two papers mentioned above, in the sense that the decentralized equilibrium leads to an educational effort which is too high. However, we show that the tax and subsidy policy that permits market efficiency to be achieved necessarily includes a financial reward to education.

We use a two-sector search-matching model in which working in a low-skill job allows some workers to acquire qualifications adequate for a better job, as in Moen and Rosén (2004) and Gavrel et al. (2010). We retain two main characteristics from the framework of the latter paper: the existence of learning-by-doing, and that of on-the-job search for trained workers looking for a better-paid job. The aim of our paper is however very different, and the endogenous behavior of educational choices is central to our contribution. More precisely, we study the reciprocal impact of educational choices of young individuals on labor market behavior. For this purpose, and in contrast to the two papers mentioned previously, our model assumes that workers can become skilled via formal education. Before entering the labor market, new workers decide on the amount of effort they wish to devote to formal education. Unlike Navarro (2011), in which payment of educational costs guarantees integration with the pool of skilled workers, and in which the choice to pay or not to pay results in the equalization of workers' utilities in both sectors – less productive and highly productive – we assume that educational effort only indicated a probability of acquiring the skills required to join the pool of applicants for good jobs. This probability of success in formal education for newcomers increases when educational effort is high. And this effort is rendered all the more important given that there is a significant difference in expected utility between workers in the high-skill and in the low-skill sectors. Those newcomers who fail, despite their effort, have to search for a low-skill job, and then begin to learn while on-the-job. Contrary to Acemoglu and Pischke (1999) and Miyamoto (2011), in which firms assume a specific cost in order to provide qualification to their employees, in our model training in low-skill jobs is treated as a spinoff from the production process. When the learning-by-doing process comes to its end workers are endowed with the same skills as (formally) educated workers (following Arrow, 1962). They can then permanently join the pool of workers with good jobs. We specifically exclude the possibility that skills obtained on the job can be lost during any spell of unemployment (as is supposed by Khalifa (2015) for example).

Contrary to these previous papers, we show here that inefficiency is not linked to educational decisions or educational costs, whoever might be bearing the cost (the worker or the firm). The distortion originates in the fact that firms with high-skill jobs underestimate the social cost of filling their vacancies with workers previously employed in low-skill jobs in which they have practiced learning-by-doing. Firms create too many high-skill jobs, and job creation is suboptimal in the low-skill sub-market. As a result, high-skill jobs are too appealing, and individuals make too great an effort to acquire formal education. This creates a problem that requires government involvement for its resolution. We show that an adequate tax and subsidy policy can restore market efficiency. Taxes must be levied on (filled) good jobs. They will ensure that hiring costs as perceived by the firms coincide with social costs.

However, these taxes distort low-skill job creation as well as educational choices. Because the high-skill sector becomes relatively less profitable and less attractive for new workers, these workers do not invest enough in education. In order to restore market efficiency, these taxes must be dedicated to the funding of two kinds of compensatory transfer. One is allocated to firms in the low-skill sub-market when they lose workers leaving them for a better job. The other is a reward that workers receive if their formal education is successfully completed. Finally, the appropriate level of tax and subsidies that should be introduced is calibrated in the model with respect to US data.

The paper is organized as follows: Section 2 outlines the analytical framework. Section 3 solves the model and develops the analysis. We define a labor market decentralized equilibrium in section 4. Section 5 studies market efficiency and states two main results: a decentralized equilibrium is constrained efficient in terms of low-skill job creation and educational choices but inefficient in terms of high-skill job creation; the laissez-faire situation is inefficient. In Section 6, we outline a self-financed fiscal policy which rewards educational success and leads to a social optimum. In Section 7, we calibrate the model with US empirical evidence. Finally, Section 8 contains some concluding comments.

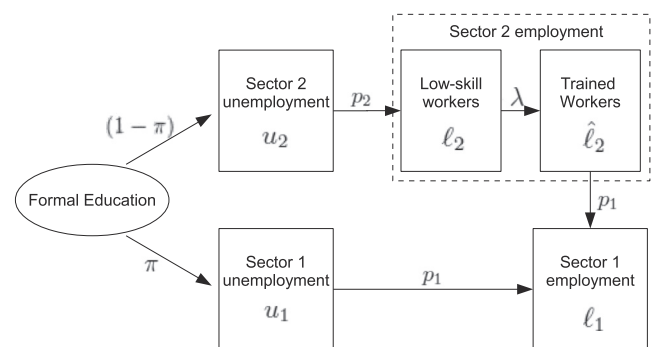
2. The model

The economy consists of two types of agents: workers and firms. We use a search and matching model of the labor market in which firms are infinitely-lived whereas workers have a finite life expectancy of $1/m$. Time is continuous and parameter m measures the workers' labor market exit rate. Each worker who leaves the market is replaced with a newcomer. The measure of the total labor force is constant and normalized to one. All agents are risk-neutral and discount future payoffs at rate r ($r \geq 0$). The labor market is segmented into two interacting sub-markets (sectors arranged into a hierarchy). Sector 2 offers low-skill jobs, while sector 1 offers high-skill jobs.

2.1. Labor force distribution

Fig. 1 presents workers' stocks (situation in regard with employment) and flows. Workers decide on their effort in formal education, e , when entering the economy. Assuming that workers are ex ante identical, they face the same level of effort e . The probability π of succeeding in the educational process is assumed to be an increasing and concave function $\pi(e)$ of educational effort e ($\pi'(\cdot) > 0, \pi''(\cdot) < 0$).

If their effort meets with success (which occurs with the probability π), workers will enter the pool of applicants for high-skill jobs (high-skill unemployment, noted u_1) and engage in a search process which succeeds at rate p_1 . They would therefore hold a high-skill job and belong to the pool indicated as sector 1 employment, noted l_1 . Workers with unsuccessful educational effort will enter the pool of applicants



Note: arrows represent transition probabilities and boxes represent workers' pool.

Fig. 1. Workers' stocks and flows toward each employment state.

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