The impact of TFP growth on the unemployment rate: Does on-the-job training matter?

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ABSTRACT

This paper seeks to gain insights into the relationship between growth and unemployment in a setting with heterogeneous skills, human capital accumulation, on-the-job training and capital-skill complementarity. We use an endogenous job destruction framework in the style of Mortensen and Pissarides (1998) with directed search. We show that when growth accelerates, a larger share of unskilled workers seeks training, increasing firms' incentives to update job-specific technology (rather than destroying it). By magnifying the impact of growth on employment, the introduction of human capital issues allows the model to more closely match the estimated sensitivity of unemployment with respect to growth. When calibrated, the model manages to reproduce the aggregate capitalization effect estimated using OECD data. We find that growth reduces unemployment for individuals receiving training, while it increases the unemployment rate of unskilled workers without training (creative destruction effect).

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1. Introduction

At the Lisbon Summit in the beginning of the new millennium, the European Heads of Government resolved that by 2010 Europe would be "the most competitive and dynamic knowledge-based economy in the world". Development of high quality vocational training in Europe is a crucial part of this strategy, especially for the improvement and adaptation of existing skills to technological changes and for the promotion of employability. As remarked by Acemoglu and Pischke (1998) even low education workers can benefit from changes in the demand for skills induced by technological progress if they receive training. OCDE economic reports reveal that the share of workers being trained on the job is not insignificant. If we consider training during the lifetime of people over 18, Eurostat statistics reveal an average participation rate of 52% (UE-27) in 2009. This percentage reaches almost 78% in the case of Denmark, 66% in the Netherlands, 61% in Finland, 57% in Germany, 55% in France, 51.2% in Italy and 46% in Spain. In the case of France, national reports reveal that in 2006, the proportion of workers receiving on-the-job training in organizations where technological change has been introduced in the past 12 months reached 62%.

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While on-the-job training seems to have played a crucial role in the economic development of western economies in recent years, it is absent from the current literature on the relationship between unemployment and growth. As shown in the present paper, this represents a major limit for capturing the truly relationship between growth and unemployment given the particular nature of recent technological progress. Bresnahan et al. (2002) conclude that the increased use of information and communication technologies (ICT), changes in organization practices and changes in products and services, taken together are the skill-biased technological progress that calls for a higher skilled labor mix[1] and thus for an increased importance of training. Jobs are on average more and more complex. A worker is now less likely to perform a unique task throughout her career. Computerization is associated with a decline in the demand for routine manual and cognitive tasks and with an increase in the demand for non-routine abstract tasks requiring a wider human capital (see Goos and Maning, 2007; Autor et al., 2003, 2006; Spitz-Oener, 2006; Maurin and Thesmar, 2004).

Lindbeck and Snower (2000) distinguish between intratask learning (which corresponds to learning by doing in the traditional sense) and intertask learning (the skills acquired in a particular task allow to improve the worker's performance in other tasks). The nature of recent technological progress enhances intertask learning but slowdowns intratask learning since ICT require wide human capital rather than an expertise in a single task. New technologies need human capital to become fully productive and, similarly, human capital (acquired through training) cannot become fully productive without a modern technology (see Bresnahan et al., 2002 or Krusell et al., 2000). This major complementary relationship has been traditionally ignored by the literature on the relation between unemployment and growth. By ignoring the skill-biased nature of technological change and thus the complementary relation between human capital and technology, the previous literature underestimates the potential productivity gains associated with technological progress (growth), and thus underestimates the impact on unemployment. This may explain why this literature runs into trouble when attempting to reproduce the estimated semi-elasticity of unemployment with respect to growth.

The major contribution of this paper is showing that by introducing human capital issues in a vintage framework in the style of Mortensen and Pissarides (1998), we magnify the impact of growth on unemployment rates. First, distinguishing between skilled and unskilled workers (heterogeneous skill workers) enables us to highlight the fact that jobs occupied by highly qualified workers have benefitted from growth brought about by recent technological change. In a model with homogeneous skill workers, the skilled-biased nature of technological progress cannot be captured. Second, when growth accelerates, the opportunity cost of training investment for workers is lower, shifting the human capital distribution to the right. Due to the complementary relation between human capital and technological progress, firms' incentive to update job-specific technology rather than destroy the job is higher when the worker gets trained since expected productivity gains are also higher. By increasing the number of positions positively affected by technological change, training (together with the complementary relation between human capital and technical progress) magnifies the impact of growth on the unemployment rate.

There is a non-negligible amount of literature analyzing the relationship between growth and unemployment. This relation is often considered ambiguous. Indeed, when growth accelerates, there are two contradictory effects: on the one hand, as Pissarides (1990) shows, an acceleration of growth has a positive effect on the employment rate, because growth "freely" increases expected profits and then provides incentives to create new jobs (capitalization effect); on the other hand, Aghion and Howitt (1994) argue that growth fosters a "creative destruction" process inducing greater job destruction and reduced job creation, yielding higher unemployment rates (creative destruction effect). Even if theoretically the relationship seems ambiguous, at the empirical level the capitalization effect clearly exceeds the creative destruction effect (see Blanchard and Wolfers, 2000; Pissarides and Vallanti, 2007 or Tripier, 2007), fostering a negative relationship between growth and unemployment.

Pissarides and Vallanti (2007) present a vintage model in the style of Mortensen and Pissarides (1998) with a representative agent and underline the difficulty of reproducing the estimated impact of the capitalization effect on employment. Working with an OCDE database from 1965 to 1995, they find that a one percentage point increase in the growth rate should decrease unemployment by 1.0–1.5 percentage points. However, in order to match this semi-elasticity when simulating their model numerically, Pissarides and Vallanti are forced to assume not only that all technological progress is disembodied, but also that firms discount the profits of a new job over an infinite horizon and that wages are independent of labor market conditions. While the rigid wage hypothesis can be easily justified (see Pissarides, 2009), the two other hypotheses are clearly unrealistic (recent technological change has been proven to be embodied and OCDE job destruction rates are not zero).

Also using a panel of OCDE countries, Langot and Moreno-Galbis (2008) estimate the impact of growth on the employment rate of both young and older workers. They find that the capitalization effect dominates the creative destruction effect in the case of younger workers, whereas in the case of older workers, the creative destruction effect is dominant. Nevertheless, using a standard calibration, they do not manage to reproduce the estimated elasticities.

Previous studies based on Mortensen and Pissarides (1998)'s work seem therefore to be missing an important aspect of the labor market that prevents them from correctly reproducing the estimated semi-elasticity of the unemployment rate in terms of growth. Specifically, one of the main drawbacks of the traditional Mortensen and Pissarides (1998) framework

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[1] Other major contributions to the skill-biased technological progress literature are Berman et al. (1994), Machin and Van Reenen (1998), Krusell et al. (2000) or Caroli and Van Reenen (2001).