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# Age-specific dynamic labor demand and human capital investment

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## Abstract

To study the optimal age-specific labor demand and human capital investment at the firm level we extend the standard dynamic labor demand model by introducing ‘age’ as a second dynamic variable and distinguish between two types of workers: ‘low skilled’ and ‘high skilled’. Applying an age-structured optimal control model we derive qualitative features of the optimal age-specific hiring and training effort. For the case of a linear revenue and production function we prove that firms do not anticipate changes in adjustment costs in their optimal decisions. This result no longer holds if a nonlinear revenue or production function is considered.

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## 1. Introduction

The balance among the age groups in the labor force is expected to change markedly over the next decades. In the majority of industrialized countries we will have a shift of the age distribution of the labor force to older ages. The changes in the age distribution of the workforce and their implications for labor market outcomes such as wages and unemployment have been extensively studied at the macro-level (e.g., Bloom et al., 1987; Korenman and Neumark, 2000; Welch, 1979). Imperfect substitutability of workers at different ages together with increasing demand for educated workers and technological progress are key factors explaining the relation between demographic change and labor market outcomes.

To understand the process of employment changes that result from shifts in the age structure of the workforce, it is important to move to the firm level. The question is then how firms will react in their hiring and firing strategy to the expected change of the labor supply that is caused by demographic change. Adjustments of the workforce will entail costs and it is the shape of these costs that determines the dynamics of employment changes (hiring and firing strategy) at the firm level. Hiring costs essentially account for recruitment (advertising, searching, screening) and initial training costs, while firing costs essentially consist in severance payments, administrative constraints and possible reorganization costs. A growing literature exists that empirically tests the shape of the adjustment costs (distinguishing between fixed and variable costs, symmetric and asymmetric costs, cf. Hamermesh, 1989; Hamermesh and Pfann, 1996) that underlie observed employment changes.<sup>1</sup> Adjustment costs also reflect differences in regulatory frameworks in the labor market. Various studies have shown that hiring costs exceed separation costs in America while the opposite holds for most European countries. As argued in Kraft (1997), high labor regulations in the EU countries put pressure on firing costs, while hiring costs are higher in the US due to investment into initial firm-specific skills.<sup>2</sup>

So far the dependence of adjustment costs on age has been neglected. Yet evidence from the management literature indicates that older and younger workers do exhibit different attributes. For a short summary of this literature, see Guest and Shacklock (2005) and Skirbekk (2005). For example, employers report that younger workers tend to have better physical strength and endurance, vision, hearing, cognitive processing, intellectual capital and adaptability. While older workers are perceived as having better people management skills, judgment that depends on experience, reliability/dependability, loyalty and attendance. These differences suggest differences by age for the initial training costs that are part of the hiring costs. Moreover firing costs increase with age, tenure and wage. Further arguments for the dependence of adjustment costs on age can be found in the search-matching models

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<sup>1</sup>It has been shown that convex adjustment costs lead to gradual employment changes, while non-convex adjustment costs may lead to instantaneous labor adjustments.

<sup>2</sup>Wasmer (2003) studies the relation between labor market regulations and human capital investment and offers an explanation why Europeans are more likely to invest in firm-specific human capital while Americans are more likely to invest in general human capital.

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