



Vintage effects, aging and productivity [☆]

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HIGHLIGHTS

- ▶ We investigate the link between age and productivity in a transitional context.
- ▶ We study the impact of economic skill obsolescence in the long run.
- ▶ Highly educated older workers are more affected than unskilled ones.
- ▶ Their disadvantage disappears over time.
- ▶ The timing of the shock differs among firm ownership types.

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ABSTRACT

We provide new empirical evidence on the link between age and productivity using a transitional context. Building on a model of skill obsolescence, we assess the long-term adjustment process following a sudden change in skills needed in production that severely worsened older workers' labor market situation. The model implies that (a) the devaluation of skills should affect highly educated older workers more severely, (b) the disadvantage should disappear over time as newer cohorts acquire more suitable human capital, and (c) the timing should differ among firm ownership types, reflecting the inflow of modern technologies and practices.

Rather than focusing on wage differentials, we estimate the firm-level productive contribution of older relative to younger workers differentiated by education level. To assess long-run trends, we adapt the augmented production function methodology developed in international literature and apply it to a linked employer–employee dataset from Hungary covering from before (1986) to 20 years after (2008) the economic transition. The results suggest that – in line with the model – the within firm productivity differential between older and younger workers following the transition was largest among the highly skilled. The fall in relative productivity followed the inflow of modern capital: the gap was largest in 1992–1995 in foreign-owned firms, while it appeared gradually and was smaller in domestic firms. The magnitude and the negative effects of the adjustment period witnessed in Hungary highlight the importance of policies aimed at providing core competencies and adult training that enable older workers to adjust to sudden economic and technological changes.

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1. Introduction

The recent availability of longitudinal datasets that link employers to data on employee characteristics has enabled researchers to estimate not only the contribution of employer's decisions regarding capital, material inputs, and the size of their workforce to firm productivity, but also the role of skill endowment and the demographic composition of their workers. Several studies attempt to

quantify the causal relationship between the age composition of firms' workforces and their productivity, mostly using data from western European countries and the United States. Most of the results document a conventional hump – shaped age – productivity profile implying that prime aged workers are the most productive, and productivity declines with age (for example, [Hellerstein and Neumark, 2004](#); [Dostie, 2011](#); [Vandenberghe et al., in press](#)).¹ The results showing a decline in older workers' productivity reflect one form of skill obsolescence²: the normal wear and atrophy of skills

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¹ Some recent studies based on within-estimates suggest that the relationship is more ambiguous: [Ours and Stoeldraijer \(2011\)](#) and [Cöbel and Zwick \(2009\)](#) conclude that productivity does not decline with age.

² "Skill obsolescence" refers to certain skills becoming outmoded or obsolete, or a gap between the skills a worker needs to fulfill a job, and the skills the worker actually possesses. [Rosen \(1975\)](#) presented seminal work on measurement and types, [De Grip and Van Loo \(2002\)](#) review the concept, causes, and policy implications.

associated with aging that actually affects the workers' human capital, called *technical skill obsolescence*.

The relationship between aging and productivity is also affected by another type of skill obsolescence called *economic skill obsolescence*, which is due to changes in jobs or the environment that lowers the value of the workers' human capital.³ This affects specific cohorts of workers in addition to the normal wear of skills due to natural aging. Rosen (1975) terms this a *vintage effect*, in that “stocks of knowledge available to society change from time to time [and] capital losses are imposed on those embodying the earlier knowledge and skills” (pp. 199–200). Though from a societal point of view these effects are not permanent since younger cohorts acquire new skills better suited to the market, they can have a significant detrimental effect on the labor market performance and activity of older workers, and the economy as a whole. Older workers experience a fall in demand for their labor and wage disadvantages. Sudden technological shocks will induce older workers to retire sooner (Bartel and Sicherman, 1993), placing a burden on government budgets.⁴ In aging populations, advancement of new technologies and growth may be hindered by the obsolescence of the skills of workers (Van Imhoff, 1988). At the same time, skill obsolescence is characteristic of current times, as production becomes increasingly knowledge intensive, and science and technology advance rapidly (Powell and Snellman, 2004; David and Foray, 2003). Thus, it is important to understand the roots and impact of economic skill obsolescence and the policy tools that can alleviate its effects: continued adult training and a focus on giving students core competencies early on that enable easier lifelong learning.

The economic transition in Hungary offers a unique opportunity to study the impact of economic skill obsolescence. The regime change led to a large-scale and sudden shock to the types of skills needed in the labor market than what is seen in developed countries. New technology and management practices were introduced rapidly, requiring skills that were different from those needed under socialism. Prior to the transition, education emphasized technical as opposed to business-related skills, and work-based experience was also particular to the socialist system, often involving dealing with shortages, inconsistencies of plans, and transactions in a seller's market (Kertesi and Köllő, 2002). These skills quickly became useless as the economy opened up and market forces began to work. Based on empirical evidence on wages, this resulted in a sharp decline of returns to experience during the transition in Eastern European countries, especially among highly educated employees who acquired most of their knowledge and experience before transition.⁵ This suggests that, 20 years later, the Hungarian transitional experience gives us an opportunity for studying the impact of economic skill obsolescence and the adjustment process following a sudden shock to the value of skills. Our goal is to use the case of the Hungarian transition to assess the long-run effects of a shock to the value of older workers' skills, using data covering a long time period after the transition in 1990. We assess how long the negative effect on older workers' productivity lasted, and what the magnitude of the impact was. These lessons are useful not only for other transitional countries, but also for anyone experiencing increases in foreign direct

investment, skill-biased technological change, or other vintage shocks to the value of skills in their economy.

Rather than estimating wage returns and interpreting them as the extent of skill obsolescence, we focus directly on the effect of the changes in the relative productivity of older workers.⁶ This allows more precise measurement, as wages may face downward barriers (such as collective agreements, minimum wage, deferred payment schemes, etc.) that mask the depreciation of skills. We adapt a methodology developed in previous international literature, and apply it to a large and representative dataset from Hungary covering a few years before the transition (1986) to almost 20 years after the transition (2008). The basis is the method pioneered by Hellerstein and Neumark (1999), who estimate a production function augmented with the workforce composition of the firm, as seen in most of the papers of the productivity and aging literature. This methodology allows us to estimate the productive contribution of various worker groups relative to a reference group at the firm level, using data on output, inputs, and various controls. The dataset used in the paper, the Hungarian Wage and Employment Survey (WES), is a nationally representative linked employer–employee dataset that includes detailed variables of a variety of firm characteristics, and linked key demographic data of a random sample of workers.

The transitional environment and the nature of the skill obsolescence motivates investigating the old–young relative productivity using different specifications than those applied in previous studies on western European countries and the United States. One implication of the model of economic skill obsolescence is that it should affect highly skilled workers to a larger extent than the low-skilled, since the material learned in elementary schooling does not change significantly over time (Neuman and Weiss, 1995). To verify this hypothesis, we investigate the productivity of older employees relative to the younger ones separately among skilled and unskilled employees. We define less aggregated worker groups than previous studies using the Hellerstein–Neumark methodology: our worker controls are composed of the interactions of education (with or without high school or college) and age (below or over 45). The older worker group is defined in an unconventional way – above the age of 45 – that is better suited to the transitional analysis.

A second testable implication is that if the value of skills changes due to a sudden shock in production technology or business practices (as opposed to natural aging), then over time, skill obsolescence should play a less and less important role in influencing the productivity of older employees, as new cohorts of older workers acquire some of their skills in the post-transitional period. Besides expecting that the relative productivity of older employees varies by education level, we expect that, among skilled employees, the old–young productivity differential becomes smaller over time as new cohorts of older workers catch up, and acquire skills matching the needs of the market. On the other hand, we do not expect to see such a pattern among unskilled employees. To assess this hypothesis, we provide estimates for five distinct time periods between 1986 and 2008, motivated by the major phases of economic development described in the next section.

Finally, the model implies that skill obsolescence should follow the inflow of modern capital. If the higher appreciation of the skills of the young was brought about by better matching to new technologies and practices, we would expect the old–young productivity differential to be larger in modern sectors and firms. Though we do not have information on firms' technologies and practices, previous studies suggest that foreign direct investment was the main channel through which modernization first occurred, so foreign ownership can be used

³ A well-known example of this was the introduction of computers in the workplace, which required new types of competencies and cognitive skills (Bresnahan et al., 2002).

⁴ Mincer (1989) points out that furthermore, in cases of sudden technological change firms have less incentive to retrain older workers, making government intervention even more crucial.

⁵ In Hungary, Kertesi and Köllő (2002) documented that the experience-related wage gap narrowed significantly from 1992, and the return to higher education decreased more in the case of younger cohorts. Kézdi (2002) found that the wage disadvantage of the young diminished compared to older workers, especially among the highly skilled. Studies on other transitional countries also found decreasing returns to experience in the early years of transition, for example, Rutkowski (1996) and Vecernik (1995).

⁶ Kertesi and Köllő (2002) also estimate the firm-level productive contribution of older and younger workers differentiated by skill level for 1986–1999. They document a widening productivity differential between young skilled and old skilled employees up to 1999.

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