

Ageing Labour and Firm Productivity: Evidence from Austrian Register Data

Isabel Gerstner^{1, 2} and Alexia Prskawetz^{1, 2, 3}

¹*Vienna Institute of Demography, Austrian Academy of Sciences, 1010 Vienna, Austria*

²*Institute of Statistics and Mathematical Methods in Economics, Research Unit Economics, Vienna University of Technology, 1040 Vienna, Austria*

³*Wittgenstein Centre for Demography and Global Human Capital (IIASA, OeAW, University of Vienna), Vienna, Austria*

Austria, as most industrialized countries, is facing rapid population ageing. Amid this demographic process and technological transformation, questions of productivity, labour market dynamics, and economic resilience have gained significant relevance. An older workforce poses challenges for both the social security system and the hopes of continuing economic growth. While older workers bring valuable experience and firm-specific knowledge, they may face difficulties adapting to new technologies — raising questions about their role in a changing economy. It is, however, the technological advancements in which many countries put their hopes to countervail some of the potential negative effects an ageing workforce brings, when it comes to competitiveness on the global market. Similarly, as workforce may begin to shrink in the future, education is another dimension often considered to sustain or even increase labour productivity.

Therefore, research is necessary to estimate the relationship between an ageing workforce and firm productivity, and how this mechanism interacts with firms' technology or workers' education. To study this relationship, Austria has a significant advantage compared to many other countries: the recently granted access to the Austrian register data for research. This data captures all firms operating and all individuals residing in Austria, which means that even groups that are often underrepresented in surveys are captured. Findings to such existential topics are essential for policy making to ensure a just labour market and to sustain welfare. It is the intersection between the disciplines of economics and demography that is rapidly gaining importance for pressing societal questions of our time. Therefore, this study will help support Austrian policy makers and society to make decisions for an inclusive and resilient labour market.

To put it shortly, this paper studies how workers' age composition is related to firm-level productivity. The main data source is the Austrian register data, which covers all people residing in and almost all firms operating in Austria. Therefore, individuals or firms that would otherwise be underrepresented in surveys (such as one-person businesses of owners with migration background) are covered. To address the fact that, first, capital is an estimation based on investments and second, that worker and firm characteristics are recorded once a year and are thus prone to fluctuations over the year, a Bayesian approach is applied.

Related Literature

On the macroeconomic level, an ageing workforce is generally associated with slower productivity growth. In other words, while productivity per worker is still increasing as in the last few decades, it does so at a lower rate in countries and regions where the aggregate working population is getting older (André, Gal, and Schief 2024; Allen 2023; Lisenkova 2020). However, tracing back a productivity growth slowdown to older workers is too simplistic. Aggregate numbers often overshadow other dynamics that may influence overall productivity. Since it is firm performance that is summed up to determine an economy's aggregate productivity, it is the firm-level data that can uncover the true drivers. On the microeconomic level, results are mixed - some studies suggest that an ageing workforce reduces productivity, for example due to declining cognitive abilities or slower adaptation to technology (Brunow and Faggian 2018; Bryson et al. 2020; Gagliardi, Grinza, and Rycx 2023). Other studies emphasize the advantages of experience and the positive effect a larger share of older workers has on firm productivity (Bertschek and Meyer 2009; Mahlberg, Freund, and Prskawetz 2013; Lee, Song, et al. 2020). The effects of technology on productivity are generally found to be positive (Bartelsman, Dobbelaere, and Peters 2015, Acemoglu and Restrepo 2020, Czarnitzki, Fernández, and Rammer 2023).

Research questions

The project is guided by the following key research questions:

1. What is the relationship between firm productivity and the age structure of the workforce controlling for firm level and workers characteristics?
2. What role do technological intensity or workforce education play in shaping this relationship?
3. How does the strength of this relationship vary with firm heterogeneity, for example by economic sector?

Data and methodology

As mentioned earlier in the motivation, we are using the register data from the *Austrian Micro Data Center (AMDC)*. Austria has put itself in a favourable position in research by granting access to this data. More precisely, for the employers' side, the *Structural Business Statistics Survey* is used. It contains information regarding the economic activity of the firm, different types of capital investments, and annual numbers on total value added and labour costs, among many other things. For the employees' side, we use the *Register-based Labour Market Statistics*. This dataset includes crucial information regarding socio-demographic characteristics of all individuals living in Austria, including age, education levels and field, gender, nationality, occupation and whether he or she works part-time. Through unique identification numbers, the datasets were linked, i.e., each employee and self-employed (any form of occupation) is linked to their exact workplace. The workers' characteristics are then aggregated to the firm-level. In other words, the result is a linked employer-employee dataset that contains all Austrian firms recorded in the administrative data of the AMDC for the years 2013 to 2022. For each firm, we know its characteristics as well as its staff composition, such as the share of females, the share of older workers, or the share of workers with high education.

A major concern that will be addressed in this study is the uncertainty regarding the capital stock of a firm. It is often not available as such in survey or administrative data since it is not requested. Alternatively, it is estimated. Similarly, in our study, we have estimated the

capital stock using the perpetual inventory method based on investments of a firm. To account for this uncertainty, we will depart from the frequentist approach and apply Bayesian estimation. The capital stock is of decisive importance to estimate productivity of a firm since in the Cobb-Douglas production function, as it enters as one of the key inputs in firm production, together with labour. Similarly, the observed labour input may deviate from its true value, as the administrative data is collected once a year on a specific date. Depending on theoretical considerations and empirical findings, the priors can be selected such that they reflect how much uncertainty we expect in the measurement of each variable. By including prior beliefs about the relationship "productivity - capital", we are in turn able to analyse the relationship "productivity - ageing" more accurately. Within the productivity literature, this methodological approach supports well-established theoretical considerations and data-driven estimations.

Current and Expected Findings

Descriptive results show that the share of older workers within the working population in Austria has increased significantly in the time period 2013-2022. All age groups have, on average, increased in their level of education, especially older workers. Part-time work is most prevalent among females, being the second highest in the EU after the Netherlands, however, part-time work is also becoming increasingly common for older workers. Similarly, the firms are very heterogeneous as well in terms of capital stock per workers, size, or the share of digital capital.

Results from the fixed effects models suggest that a higher share of older workers (50+ years) is negatively related to firm productivity, where the benchmark is the share of prime-aged workers (30-49 years). Surprisingly, once we control for average labour costs of a firm, we find that the share of young workers (15-29 years) is positively associated with firm productivity. These effects are especially pronounced for micro (1-9 workers) and small (10-49 workers) firms, while for larger firms, these effects are not necessarily found.

As described earlier, many of the variables are measured with error, since the information is collected on one specific date every year. Thus, to account for possible fluctuations in e.g., the share of part-time workers or the share of older workers, a Bayesian approach is currently in work. Capital stock, an important input factor in the classical Cobb-Douglas production function, is estimated with error as described above, and will thus profit significantly from Bayesian econometrics to account for this uncertainty. The ultimate goal is to refine the analysis to correctly estimate how ageing is related to productivity and harness the potential such less-conventional methods have for economics and demography by including theoretical knowledge into a data-driven approach.

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