

The Complementarity Between Automation and Flexible Labor Contracts: Theoretical Framework and Evidence from Italy

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Long abstract. Thanks to automation, capital can be employed in more, even alternative, uses, performing more functions, tasks, and activities. Consequently, higher investments in automation make capital more flexible. Our study examines the relationship between flexible capital, proxied by investments in automation, and flexible labor, measured through temporary labor contracts. Temporary contract workers include all employees hired on a fixed-term basis, those recruited through third-party contractors or temporary work agencies, and casual workers.

Specifically, this paper aims to answer the research question: Is there a complementarity between automation and flexible labor contracts? Our main hypothesis is that there is a complementarity between flexible capital, a result of automation technologies, and flexible labor, represented by temporary labor contracts. In other words, the choice to invest in automation increases when firms opt for flexible labor contracts. We offer two main theoretical arguments to support the complementary relationship between automation and labor contracts. The first argument is related to flexibility, as firms need to adapt to various shocks. Our second argument is based on specific investments and hold-up risks.

To test the complementarity hypothesis, we analyze data on firm-level adoption of automation technologies and labor contracts in Italy, drawing from the 2015 and 2018 waves of the INAPP's RIL (Rilevazione Imprese e Lavoro) survey, covering approximately 10,450 Italian firms. For the empirical analysis, we use a question introduced in the 2018 wave of the survey, which inquired whether firms had invested in automation technologies during the 2015-2017 period. These technologies encompass a range of solutions, including, but not limited to, Internet of Things (IoT) solutions, robotics, 3D printers, automatic machines, as well as intangible assets such as cloud computing, big data analysis, and cybersecurity. We employ this variable to identify our treatment group, allowing us to focus on the impact of automation investments on labor contracts and organizational dynamics. To comprehensively depict the firm's workforce composition, we consider several variables: the natural logarithm of the number of workers, the proportion of workers holding a university degree, the proportion of blue-collar workers, the proportion of workers hired under flexible contracts, and the proportion of unionized workers. These variables collectively provide a detailed picture of the firm's workforce. When examining the firm's business dynamics, we calculate

the percentage change in employment between 2014 and 2015, represented as a logarithmic difference in the number of workers (with the number of workers in 2014 as a reference point).

Our empirical results support the complementarity hypothesis, as we find that investments in automation are likely to lead to an increased use of flexible work contracts by firms.