



ROUTINE TASKS AND THE DYNAMICS OF ITALIAN EMPLOYMENT

Is there a relationship between technological change, tasks and the dynamics of Italian employment? To answer this question, we explore the linkage between: employment dynamics at the occupation-level, tasks' characteristics (degree of "routinarity") and economic dynamics (demand, investments in physical capital and in R&D). The results show that occupations characterized by a prevalence of routine tasks are significantly penalized in terms of employment dynamics.

*Valentina Gualtieri
Dario Guarascio
(Inapp)*

*Roberto Quaranta
(Collegio Carlo Alberto)*

Is there a relationship between technological change, the nature of tasks and the dynamics of Italian employment? To answer this question, we explore the linkage between: employment dynamics at the occupation-level, tasks' characteristics (degree of "routinarity") and economic dynamics (demand, investments in physical capital and in R&D). According to a well-established literature (see, among the others, Autor and Dorn 2013), technological change tends to affect employment (both quantity and quality) in an asymmetric way. Occupations characterised by a relevant share of "routinary" (i.e. codifiable) tasks face a relatively stronger risk of substitution by machines and process innovations. On the contrary, occupations characterized by tasks entailing a high degree of creativity and/or dexterity tend to face a lower risk of substitution. In addition, occupations characterized by a large share of complex tasks might experience an increase in demand given the (potential) complementarity between new technologies and these types of tasks.

Indeed, the technology-tasks-employment nexus can be relevantly affected by the economic and structural conditions shaping the economy at different stages. In a context of weak economic growth, for instance, uncertainty about future demand flows may reduce firms' investment

propensity delaying the introduction of new technologies. Similarly, a specialization characterized by the prevalence of low-tech sectors and/or the presence of credit constraints might weaken companies innovation intensity reducing the probability of technological unemployment but, at the same time, increasing the risk of “non-technological” unemployment - i.e. the risk of job destruction connected to the reduction in companies’ relative competitiveness.

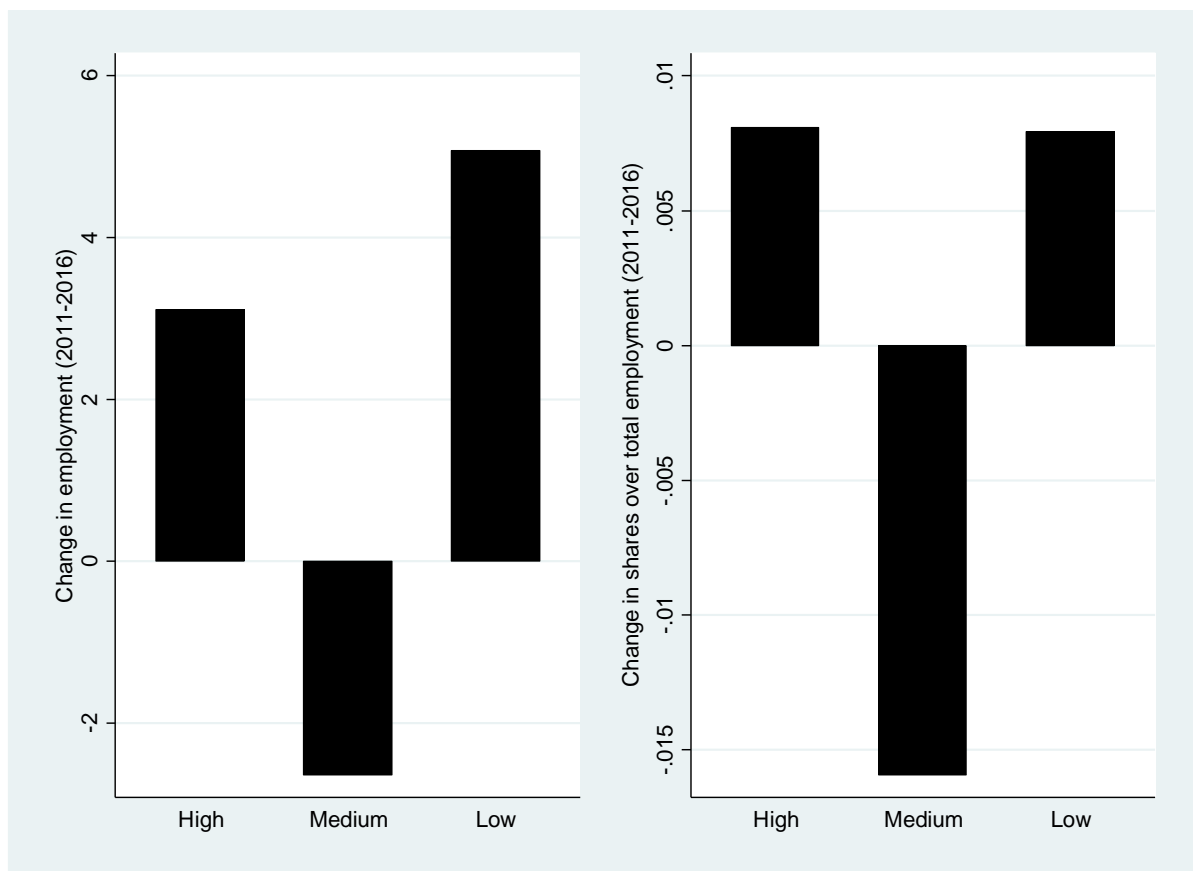
This policy brief builds upon Quaranta et al. (2017)¹ investigating the linkage between employment dynamics at the occupation-level; tasks (degree of “routinarity”); workers’ characteristics (gender and degree); contract types (share of employees with fixed-term contracts over the total) and economic dynamics (demand, investments and R&D expenditure) observed at the industry-level. The analysis takes advantage of a unique dataset merging different information sources at a high level of detail and disaggregation (see box 1). This makes it possible to grasp very accurately all factors affecting the relationship between technological change and employment. In particular, the availability of task-based variables for each Italian occupation allows distinguishing the latter according to the “true” subject of a potential machines-driven crowding-out: not occupations themselves, but routinary tasks. Unlike complex, interactive and not easily “encodable” activities, in fact, routine tasks are replicable that is they can be easily described (or observed) and replicated by machines. Moreover, the availability of highly detailed information about tasks allows overcoming some of the limitations faced by previous empirical works attempting to answer the same research question: the use of proxies such as education to discriminate between more or less routinary occupations; or the adoption of low levels of disaggregation not being able to dig into the heterogeneity characterizing elementary occupations. Moreover, the joint use of highly disaggregated occupation-level information, on the one hand; and economic variables - such as investment in physical capital and R&D - on the other hand, helps capturing the crucial interaction between supply and demand factors in explaining the relationship between economic dynamics, technological change and employment.

The analysis focuses on the 2011-2016 period and is structured along two lines. First of all, a series of descriptive evidence is provided regarding the relationship between employment dynamics, occupations and the degree of tasks’ “routinarity”. Secondly, an econometric analysis is carried out studying employment dynamics at the occupation level (4-digit) in relation to the

¹ [Inapp policy brief no. 4/2017](#)

relative routinarity of tasks; to workers' individual characteristics (measured at the occupation level, and including variables as young workers, women, graduates as well as the share of individuals with temporary or open-ended contracts); to the dynamics of demand, investments and R&D expenditure observed in (4-digit) sectors where each occupation operates. The degree of tasks relative routinarity is measured using the Routine Task Index (RTI) proposed by Autor and Dorn (2013).

Figure 1 – Change in employment and shares over the total. Years 2011-2016. High, medium and low-skilled

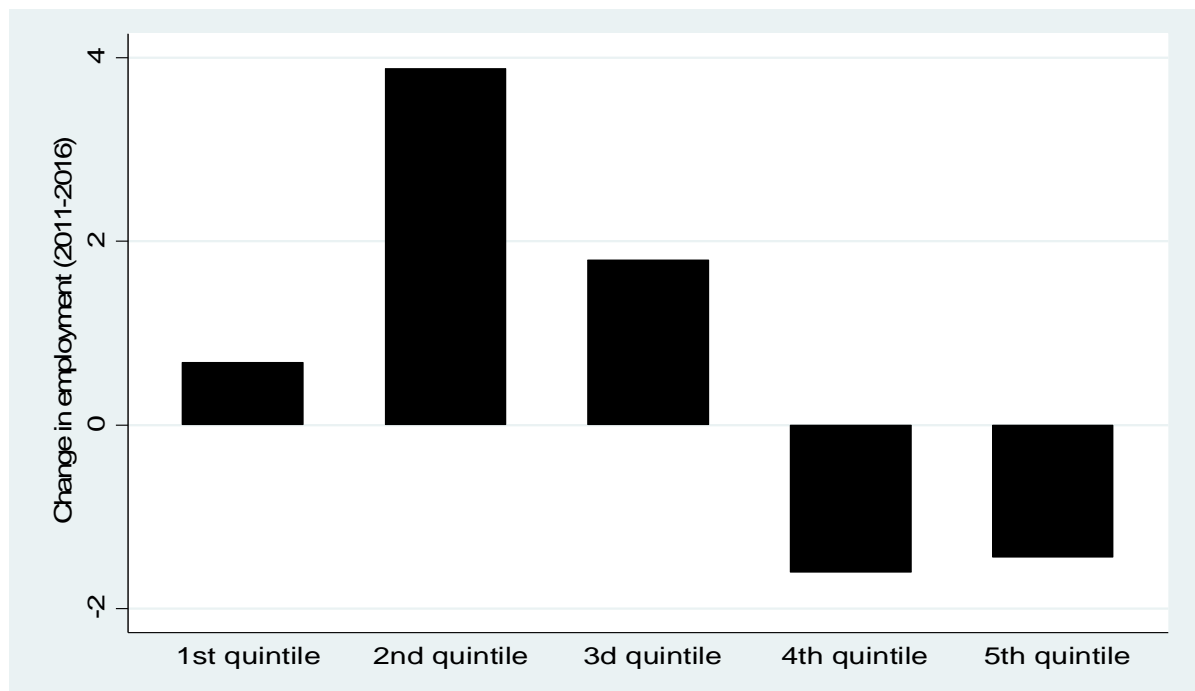


Source: Inapp elaboration on RCFL-Istat data

The RTI is a composite index obtained by summing the (ICP Inapp-Istat) variables capturing the degree of routinarity of manual and cognitive tasks - indicators overlapping the manual and cognitive routine task indexes used by Autor and Dorn (2013) to build the RTI for the US economy - and subtracting the variables capturing the degree of tasks' "non-routinarity"/complexity (see Autor and Dorn (2013) for a detailed description of the indicator). As a preliminary evidence, we report the change in employment at the occupation-level (both number of employees and share over total employment) distinguishing workers between high, medium and low-skilled. In terms

of dynamics, it emerges a significant polarization: high and low-skilled occupations display a remarkable growth; while the opposite is true concerning medium-skilled. Looking at the employment structure, high and low-skilled workers shares tend to increase, while the share of medium-skilled displays again a marked contraction. According to the high, medium and low-skill distinction, thus, a process of polarization seems to be identifiable.

Figure 2 – Variation in employment by quintile of the distribution of RTI. Years 2011-2016



Source: Inapp elaboration on RCFL-Istat and ICP data (Inapp-Istat)

Figure 2 provides a descriptive representation of the relationship between employment dynamics (2011-2016) and the degree of tasks' routinarity characterising each 4-digit occupation. The change in employment is inspected along the quintiles of the RTI index distribution. The data display a negative correlation between relative intensity of routine tasks and employment dynamics. Occupations belonging to the first three quintiles of the RTI distribution (i.e. occupations characterized by a low or medium presence of routine tasks) tend to grow over the considered time span; with the highest rate registered for those occupations falling within the 2nd quintile of the distribution. Contrarily, occupations characterized by a prevalence of routine tasks (those falling into the 3d and 4th quintile, and thus facing a potentially higher risk of substitution) tend to decrease significantly over the same period.

The descriptive analysis presented so far has shown how the employment dynamics of Italian occupations is negatively correlated with tasks' relative routinarity. In order to verify further such preliminary finding, we run an econometric model regressing the change in employment at the

occupation (4-digit) - sectoral (1st digit) level against: the degree of routinarity of tasks and a large number of controls. Four specifications are tested. In the first specification, the change in employment (2011-2016) is analysed in relation to the RTI indicator alone – i.e. we use a dummy variable assuming value 1 if an occupation falls into the 4th and 5th quintiles of the RTI's distribution and 0 otherwise. The following specifications are characterized by the stepwise inclusion of individual controls (share of women, young people, graduates and temporary workers in the reference occupation); sectoral controls (rate of change of the median wage, revenues, investment and expenditure on R&D); and temporal and macro-sectoral dummies. The results seem to confirm the negative role played by the highly routinary tasks in explaining employment dynamics at the occupation-level. The coefficient associated with the RTI dummy (table 1) is negative and statistically significant all across the proposed specifications, corroborating results' robustness.

Table 1 – Pooled-OLS estimates: rate of change in employment (2011-2016) vs RTI

	Model 1	Model 2	Model 3	Model 4
RTI (Routine task index)	-0,0451** (0,0143)	-0,0530** (0,0164)	-0,0522** (0,0160)	-0,0345* (0,0160)
Occupation-level controls	No	Yes	Yes	Yes
Sectoral controls	No	No	Yes	Yes
Time and macro-sectoral dummies	No	No	No	Yes
# Observations	11997	8680	6933	6933

Note: clustered std. errors in parentheses (* p<0.10, ** p<0.05, *** p<0.010)

The analysis shows that a high incidence of routine tasks (manual and/or cognitive) tends to penalize, in terms of employment, occupations that are characterized by a relatively higher share of such tasks. Among the occupations falling within the 4th and 5th quintiles of the RTI distribution we found, for example, *workers employed in labor-intensive machinery in industries such as textile and printing*. These occupations, as the results of the econometric model reports, seem to be penalised in terms of employment when compared to the whole sample average. On the other hand, occupations characterized by a large share of “strictly human” tasks - such as *health and rehabilitation professionals or those specialising in training activities* (both of these professional profiles are characterised by a significant weight of tasks implying a high degree of creativity, adaptation and management of interpersonal relations) - tends to grow relatively more than the whole sample average. The negative impact of routine task on employment turns out to be particularly significant from a statistical point of view and robust to the inclusion of a large number of individual and sectoral controls. In descriptive terms, a tendency towards polarization of the Italian occupation structure seems to emerge.

Box 1 – The database

The adopted database matches information on:

- employment dynamics, workers' individual characteristics and contract types at the 4-digit occupation-level (according to the CP Istat 2011 classification) - data stemming from the Istat Continuous Survey of the Forces of Labour (RCFL);
- tasks characteristics at the 4-digit occupation-level - data drawn from the Survey of Professions (ICP) conducted by Inapp and Istat in 2012;
- demand, investment and R&D expenditure of companies operating in the 4-digit ATECO industry where the 4-digit individual occupations are distributed – balance sheet data stemming from the AIDA Bureau Van Dijk database.

As already mentioned in Quaranta et al. (2017), the ICP constitutes the only information base available in Europe overlapping the Occupational Information Network USA (ONET) and capable to provide information on tasks, competences and nature of the work performances to the maximum degree of detail available in the classification of the Italian occupations.

Box 2 – The econometric model

The estimation is carried out relying on panel data (2011-2016) and using a pooled-OLS estimator with clustered standard errors (occupation-industry), including sectoral and temporal dummies. A Pooled-OLS has been estimated. The employment variation (log difference) per occupation-industry cell is regressed against a dummy variable assuming value 1 if the occupation falls into the 4th or 5th quintile of the RTI distribution and 0 otherwise. The set of controls included in the analysis is: lagged change in employment, lagged change of the (median) wage at the 4-digit occupation-level, share of women, young, graduates and workers with temporary contracts for each 4-digit occupation, (lagged) change in total revenues, investments and R&D registered at the sectoral level. The explanatory variables are included in the model at their first lag to improve estimations' consistency. The economic variables are calculated as weighted averages of the totals observed in the 4-digit ATECO sectors where each 4-digit occupation is distributed. For each cell (4-digit occupation-1 digit macrosector) representing the unit of analysis in the regression model, economic variables are computed as the weighted average of variables observed at the ATECO 4-digit industry where each 4-digit occupation belongs to (the distribution of employment by 4-digit occupation over all 4-digit industries has been calculated using Istat RCFL data).

The macro-sectors included in the analysis are: agriculture, hunting and fishing; energy industry, extraction of energy materials; processing industry; construction industry; commerce; hotels and restaurants; transport and communications; monetary and financial intermediation, real estate activities; business services and other professional and entrepreneurial activities; public administration, defence, compulsory social security; education, health and other social services; other public, social and personal services.

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