IARIW-ESCoE Conference
"Measuring Intangible Assets and Their Contribution to Growth"

Management, Skills and Productivity

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Organisational capital (OC) including – but not limited to – managers, workforce skills and firm productivity seemingly go hand in hand. However, more needs to be known on the extent to which industries invest in OC and about the way workforce skills and the skills of the OC staff relate to productivity.

This paper investigates the relationship between OC workforce skills and labour productivity, at the industry level. In particular, it looks at the way numeracy skills, as well as task-based skills, such as Information and Communication Technology (ICT) and Science, Technology, Engineering, and Mathematics (STEM) skills, influence productivity, and whether differences emerge in the way the skills of the OC workers and of the other workers relate to industry performance. As the digital transformation unfolds and digital technologies progressively penetrate all sectors, albeit at a different speed and in a different fashion (Calvino et al., 2018), it is reasonable to expect that cognitive abilities such as numeracy will need to be complemented by skills related to the use of ICT at the workplace.

The work is motivated by the need to better understand the role of human capital in fostering economic performance, to put people and workers back at the centre of inclusive growth policies. By looking at the complex interaction between OC, skills and productivity, the analysis contributes to shed light on the relationship between workforce and management skills, on the one hand, and industry performance, on the other hand; and on the way skills dispersion relate to productivity levels.

The work builds on OECD work estimating investment in OC (Le Mouel and Squicciarini, 2015) and constructing cognitive and task-based skill-related indicators (Grundke et al., 2017) using data from the Programme of the International Assessment of Adult Competencies (PIAAC). The analysis further exploits industry-level output information from the OECD Structural Analysis (STAN) database, and information from a number of other industry-level OECD datasets. The first part of the analysis is exploratory in nature and relies on a simple Ordinary Least Square (OLS) approach that relates productivity with variables accounting for skills and OC, as well as industries' main features (e.g. investment in net fixed assets). The results show that workers in OC-relevant occupations are better endowed with ICT as well as with STEM skills compared to non-OC workers with the highest average scores being observed in ICT (J) and finance and insurance (K) industries. Sectors whose workforce is less endowed with such skills include

wholesale and retail (G), transport, accommodation and food (H&I) and other social and personal services (R&S).

We further find that greater educational attainment of the workforce, measured in terms of the share of highly educated workers in the industry - which can be considered as a proxy for "better" human capital - is always positively correlated with economic performance. A positive and significant correlation also emerges when looking at the role of STEM skills for labour productivity. Such a positive link emerges for those workers that are not involved in OC functions and is even larger in the case of OC workers. Taken together, results stress the need to raise the bar, in terms of endowing all workers with good STEM skills, and to have an even better skill endowed OC staff, given that labour productivity seemingly arises in a relatively more important fashion from their abilities.

Results further show that the ICT task-based skills and STEM skills may to some extent be related. For the bulk of the workforce, i.e. non-OC workers, ICT task-based skills do not emerge as being significantly associated with higher labour productivity when the STEM skills are taken into account. Moreover, differences in ICT task-based skills between OC and non-OC workers appear to negatively correlate with productivity, which suggests that in principle not all workers need being endowed with ICT skills. However, when ICT features prominently in the organisation of a company or industry (as captured by the ICT skills that OC staff needs to be endowed with), then (greater) differences in the ICT skills between OC and non-OC staff may trigger (more important) "lost in translation" type of mechanisms. These may lead to relevant information getting lost or overlooked, thus harming the economic performance of the industry.

The second part of the paper explores the existence of causal links by addressing possible selection bias and the endogenous nature of skills through the implementation of a three-step estimation model. This combines a Heckman selection model with an instrumental variable approach and relies on two exclusion restrictions. The aim is, firstly, to control for the possible selection and self-selection of individuals with higher skills into larger firms, as the latter tend to be more productive and offer better salaries (Wagner, 1999). Secondly, it addresses potential endogeneity problems related to reverse causality and omitted variable biases. The exclusion restrictions capture the social mobility of workers and the use of ICT transactions done while being at home. Parental education and email use at home are used to instrument numeracy and ICT skill scores, to address the possible endogenous relationship that may exist between economic performance and skills of the workforce. While overall results generally confirm the findings of the simple OLS regression, not all coefficients remain statistically significant. The majority of the model specifications confirms a negative and significant effect for the ratio between ICT scores for OC and non-OC workers and a positive significant effect for STEM skills, which is even larger for OC staff than for non-OC staff.

Among others, our results call for the need to know more about the role of training policies in upgrading STEM and ICT task-based skills, as well as about the mechanisms through which the skills of all workers, both OC and non-OC workers, affect productivity. In this respect, it is crucial to better understand how the different skills of OC and non-OC workers relate to innovation output and to higher productivity.

Existing research has shown the importance of investment in Research and Development (R&D) for innovation output and of innovation for economic performance (Crépon, Duguet and Mairesse, 1998; Criscuolo, 2009; Mason, Rincon-Aznar and Venturini, 2019). However, relatively little is known about the characteristics of human capital that are key in translating R&D into innovative output, and for innovative output to boost productivity. This paper investigates how innovation, organisational capital (OC) as well as human capital endowment and upgrading relate to labour productivity. In particular, it looks at how labour productivity and the probability of an industry to innovate are shaped by its OC, workforce's cognitive skills (proxied by numeracy), task-based Information and Communications Technology (ICT) skills , Science, Technology, Engineering, and Mathematics (STEM) skills, the dispersion of cognitive skills, and investment in different types of training.

This work sheds light on the way cognitive and task-based skills (i.e. the skills that workers need to perform their job task; see Grundke et al. (2017)) contribute to industries' innovation abilities and economic performance. Also, as skills can and should be nurtured, it is important not only to account for existing skill endowments but also for the upskilling of human capital taking place in industries (Destré, Lévy-Garboua and Sollogoub, 2008). Therefore, the analysis explores the way innovation output and different types of training relate to labour productivity, distinguishing between formal, informal and non-formal training (as defined in Squicciarini et al. (2015)). We also take into account OC, one of the key knowledge-based assets of firms and industries. It ensures the long-term functioning of firms and helps workers deal with the inherent difficulties associated with everyday challenges as well as long-term strategies and decisions. These include innovation and technological change, as well as organisational change, and is therefore an important driver of firm value and economic growth (Francis, Mani and Wu, 2015).

The analysis first explores these relationships through a simple Ordinary Least Square (OLS) regression model and then implements a Heckman selection model to investigate causal links. To do so, we rely on a number of purposely created indicators. First, we build on OECD estimates of investment in training, on indicators of cognitive and task-based skills as well as OC workers constructed using data from the Programme of the International Assessment of Adult Competencies (PIAAC). Secondly, patent counts at the country-industry level, compiled by matching patent applicants' names from the Worldwide Patent Statistical Database (PATSTAT), to firms, and then using industry classifications from company-level data contained in ORBIS ©. Finally, we use output information from the STAN dataset.

The results show that innovative outputs, investment in OC and physical capital intensity (measured by net fixed assets) are positively and significantly related with labour productivity. Also, investment in training relates positively and significantly with labour productivity. When disentangling the different types of training, it becomes apparent that this effect is mainly driven by informal training.

Findings on the role of skills are slightly more nuanced. While STEM skills generally do not show a significant correlation with labour productivity, ICT as well as cognitive skills do so in part. It further appears that ICT skills are also linked indirectly to labour productivity, through their strong and positive correlation with innovative activities. Finally, dispersion in cognitive

skills, measured by the difference between the 10th percentile and median numeracy score, has a positive and significant coefficient in the majority of the labour productivity models. As a result, it seems to be important to not only invest in the bottom of the skill distribution to foster inclusion and help to contain wage polarisation, but also in the very top of the skill distribution, to increase productivity.

Overall, our results call for the need to upgrade ICT task-based skills to facilitate innovative activities and improve productivity. Moreover, they emphasise the need to know more about the role of training policies in upgrading skills and supporting innovative activities, with the aim to improve productivity, either directly or indirectly. They clearly highlight the importance of informal training, suggesting that it is crucial for policy makers to engage with and encourage firms to evolve into learning organisations, as these are the most productive ones.