ERF Economic Research Forum
ERF POLICY BRIEF

ERF Policy Brief No. 39 | June 2018

The Use of ICT and Employment Generation

In a nutshell

- *The World Bank (2016) estimates that 57 percent of workers in OECD countries are at risk of losing their jobs due to automation and computerization in the next 20 years.*
- *This, however, has not yet come into effect in Turkey. We found that information and communication technology (ICT) has an employment-generating effect in the Turkish manufacturing industry, especially in low and medium technology intensive sectors.*
- *Although the employment-enhancing effects are confirmed empirically for both tangible and intangible ICT capital, our findings indicate that tangible ICT capital has a stronger employment-generating impact than that of intangible ICT capital.*
- *The share of skilled workers increases with the use of ICT.*
- *Using high levels of ICT will probably keep more skilled/productive workers at work.*
- *There is a need for encouraging ICT use in industries where ICT enhances employment in order to foster growth and the creation of new jobs.*
- *In order not to lose the race against machines (i.e. the employment destruction effect of digitalization), the policymakers of developing countries should determine the readiness of the country and create new tools and institutions to take advantage of ICT and digitalization.*

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Introduction

The employment creation/destruction impact of information and communication technology (ICT) has attracted considerable attention over the past decades from researchers and policymakers (Sabadash, 2013; European Commission, 2016; OECD, 2016). Given the background literature on this debate, there is no doubt that the use of ICT leads to higher labor productivity (Ucdogruk Gurel and Kilicaslan, 2016; Kilicaslan et al., 2017). ICT also has a potentially significant impact on the

labor market; on the one hand, while the new ICT kills many jobs, it also generates new employment opportunities sourcing from new product and service markets (see Kilicaslan and Tongur (2017) for further discussion).

There are two main theoretical approaches in the literature on the impact of ICT on employment: the substitution mechanism and the compensation mechanism. The substitution effect briefly asserts that employment destruction emerges as traditional industries improve their technology. This is because new technologies require less labor, and therefore the laborsaving effect of ICT dominates. However, the compensation mechanism claims that the laborsaving effect of technological progress may be compensated by indirect market-oriented effects; meaning that underlining technological change leads to employment generation in the long run. Specifically, the use of new technologies (especially ICT) leads to a lower production cost and creates new investments and jobs. In other words, technological change induces the creation and commercialization of new products, and thereby the creation of new jobs.

There exists sizable empirical literature on the impact of technology on employment. There is, however, no consensus on the direction of the employment creation/destruction effect of ICT in previous studies (for a detailed survey, see Sabadash, 2013). Given the ambiguous results in this empirical literature, this research examines the impact of ICT capital on employment generation in the Turkish manufacturing industry. The findings provide some critical insights for policy.

ICT Capital Generates Employment

In order to explore the effect of ICT capital on employment in the Turkish manufacturing industry, we estimated numerous models using the labor demand equation augmented with ICT capital in a dynamic specification at the firm level (Kılıçaslan and Töngür, 2017). Our results provide statistically significant coefficients for the standard variables in the labor demand equation for all the estimated models. The real wage coefficient shows a negative and significant value, which is consistent with our expectations, indicating a negative relationship between labor demand and wages. Firm output has a positive effect on employment, which means that the expansion of production requires more labor.

The baseline estimations show that ICT capital has a positive impact on employment. Moreover, tangible and intangible ICT capital has a significantly positive impact, reflecting employment-enhancing effects. By splitting the sample in accordance with technological intensity, ICT capital has a positive effect on employment in low and medium technology sectors. In addition, our results show that tangible ICT capital has a stronger employment-generating impact compared to intangible ICT capital.

The job-creating effects of ICT don't seem significant for high technology firms, although the coefficient of ICT capital is found to be positive. The fact that we did not find statistically significant coefficients of ICT variables in high technology firms might be due to a very small sample size in high technology sectors. In other words, the hypothesis that ICT capital benefits job creation in high technology sectors may not be rejected. One other reason might be that the use of ICT in these industries is already very high. Therefore, the marginal impact of ICT use may not be significant in high technology intensive manufacturing industries.

Is the employment impact of ICT the same in all manufacturing sub-sectors?

The answer is no. We estimated the labor demand equation by splitting the sample into two-digit sectors (NACE Rev. 2) to investigate the impact of ICT capital on employment at a more disaggregated sector level. The employment-generating impact of ICT is confirmed for most two-digit sectors, whereas it is not significant for some sectors. However, there are no findings on the employment destruction impact of ICT by two-digit sectors. Moreover, the job-creating

effects are quite strong for the following manufacturing industries: food products, textiles, chemicals and chemical products, other non-metallic mineral products, electrical equipment, machinery and equipment, and motor vehicles, trailers and semi-trailers.

Except for food products and textiles, the industries where ICT has an employment-enhancing impact belong to medium technology intensive sectors. This finding is consistent with our main results, which indicate that the strongest job-creating impact of ICT exists in medium technology firms. Alternatively, the medium technology intensity group can also be divided into two: medium low and medium high. Taking this structural difference into account, our results by two-digit sectors show that ICT capital generates employment in all medium high technology intensive two-digit sectors, except for "other transport equipment." This reinforces the idea that the employment-generating impact exists strongly in industries using medium high technology.

Although there is no evidence of a job loss effect even by sub-sectors in our results, there is sectorial heterogeneity with respect to the effects of ICT on employment. This implies that sub-industries of manufacturing have their own characteristics in terms of compensation and substitution impacts. The compensation effect dominates the substitution effect in most of the sub-industries whereas they cancel each other in some other sectors, leading to a neutral impact of ICT on employment.

Policy Recommendations

Within the context of the substitution mechanism, the hypothesis of skill-biased technological change implies that the share of skilled workers increases with the use of ICT. Therefore, this process can be expected to require more skilled/productive workers. This underlines the importance of human capital accumulation, and thus education. Therefore, policymakers should design specific training programs according to sub-industrial requirements, and improve education systems to increase overall human capital/quality of workers.

Policymakers should extend the coverage of the existing incentives and support programs especially via tax cuts (start-up taxes, special communication taxes…etc.), and other factors supporting innovation and technology. Also, they should constitute new research and development centers, technology development zones, and university-industry collaboration mechanisms, in addition to making existing channels more efficient in order to facilitate new employment opportunities.

There should be coordination between support mechanisms. To this end, two points are of critical importance. First, all incentives and support mechanisms should complement each other. Second, there should be a periodic evaluation of the effects of supporting factors. Therefore, incentive mechanisms should be reconsidered depending on their achievements.

Given that there is a sectorial heterogeneity with respect to the effects of ICT on employment, policymakers should be aware that detailed industries have their own characteristics in terms of compensation and substitution mechanisms. Consequently, a policy setup should consider sectorial heterogeneity for the priorities within the context of industrial policy. This implies that some policies should be selective according to the priorities of targets and sectorial characteristics.

ICT development and the momentum of digitalization are, without a doubt, a component of the fourth industrial revolution (Industry 4.0). This implies the high transformation speed of the production systems (artificial intelligence, smart machines…etc.). Humankind also risks losing this race against machines (i.e. the employment destruction effect of digitalization may dominate in the future). Therefore, policymakers should consider putting the compensation mechanisms of ICT diffusion into force to prevent job losses. In this regard, the policymakers of developing countries should focus on the readiness of the country to take advantage of ICT and digitalization.

Further Insights

Indeed, solving the puzzle of the employment creation/destruction impact of ICT may require addressing some additional issues. First, the impact may depend on innovation type, i.e. product innovation and process innovation (e.g. Vivarelli, 2012). Although most of the studies in the literature underlined that product innovation is likely to be more labor-friendly while process innovation has labor-saving impacts, further research is needed to empirically discover the employment-ICT nexus. Another issue, linked to the former, is the heterogeneity of industries according to ICT-producing and ICT-using positions; the impact of ICT on employment varies in different industries (e.g. Biagi and Falk, 2017). Finally, comprehensive research on the employment creation/destruction effects of ICT by using datasets at different aggregation levels (macro, sector, firm) at the same time may disentangle elusive impacts, as suggested by Sabadash (2013) and Vivarelli (2014).

Acknowledgement

This policy brief is based on research funded by the Economic Research Forum (ERF) under the project call "Labor Demand in the MENA Region." The authors would like to thank ERF for the funding and administrative support. The empirical results in this research were obtained using Annual Industry and Service Statistics of the Turkish Statistical Institute (TurkStat), a firm-level database for the period 2003-2013. However, the results and the interpretations expressed in this study are the exclusive responsibility of the authors, and by no means represent official statistics.

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