Innovation, Employment and Skills

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The fear of technological change conveyed by the spectrum of rising unemployment is a topic that can be easily tracked back to the first industrial revolution. Opposing the popular distress, most economists pondered the role of the compensating mechanisms triggered by technical change: increasing productivity raises the demand for new products and creates new jobs to replace the old. But, are the new jobs better? And if they are, do their benefits reach all the displaced? Technological innovation is expected to boost economic growth and to have a sizable impact employment. Policy circles often expect growth to solve unemployment problems, but economic growth and productivity growth can cast competing forces acting on labor demand. Have innovation a dominating labor-saving impact, aggregate demand may suffer as a consequence of technological unemployment and reallocation of workers in low productivity jobs could jeopardize the productivity gains at the national level. The employment intensity of growth is likely to be mediated by the kind of innovations introduced. Neither economic growth always lead to more employment, nor productivity growth necessarily reduces it.

The kind of shifts in employment that innovation brings matters for the inequality debate and the definition of appropriate employment policies. Increased inequality in developing countries has been associated with an increase in the skill premium prompted by globalization. Employment has been a major preoccupation in developing countries dealing with technical progress and trade liberalization. These processes are often interlinked as trade liberation increases competition forcing firms to incorporate technology to survive. Trade liberalization during the 1990s was associated with increasing productivity, as firms responded to the reductions in trade barriers incorporating capital intensive technologies, but also significant job destruction and wage dispersion.

Thus, the objective of this study is on the effect of innovation on labor demand. In particular, the absolute level of employment and the skills composition of the labor force. We aim to analyze the impact of productivity-enhancing innovations and product innovation. Productivity-enhancing innovation is broader than the commonly used process innovation as it includes also organizational and commercialization innovation.

We expect the innovative strategies of Uruguayan firms to be dominated –not exclusively- by the adoption of technologies produced in developed countries. Such technologies are likely to be more skilled-biased than the locally developed ones. Hence the adoption of new technologies is likely to increase the relative demand of skilled workers.

Economic theory does not provide a clear prediction of the employment effect of innovation since the net result depends on: (1) the type of innovation; and (2) the interplay between displacement and compensation effects, (3) the institutional framework, among others. Productivity-enhancing innovations that improve efficiency in the production process are likely to reduce the demand for labor thereby displacing workers. Meanwhile, the introduction of new products that expands demand is expected to increase the demand for labor. Nevertheless, the relationship is not as clear. The displacement effect of productivity enhancing innovation can be offset by increasing demand (innovative firms get more sales and steal labor from their competitors). Also, when newer products are produced more efficiently, the replacement of the old product may result in labor reduction. As Harrison et al. (2014) put it, increasing productivity while holding output constant would reduce the demand for labor; the opposite ensues when increasing sales for a given efficiency level. Productivity reduces employment per unit of output but output expansion –due to enhanced competitiveness- can overcomes this effect raising employment. The data for this study came from the Innovation Activities Surveys (Encuestas de Actividades de Innovación en la Industria – EAII) collected by the National Bureau of Research and Innovation (Agencia Nacional de Investigación e Innovación – ANII). Surveys were delivered at three-year intervals. We have at our disposal the last five waves, corresponding to the years 2000, 2003, 2006, 2009, and 2012. The empirical model takes the same form regardless of whether the dependent variable is total number of workers, skilled workers, etc. As an example our dependent variable may be the rate of change in labor:

$(Lit - Lit-1) /Lit = \beta 0 + \beta 1INit-1 + \beta 2Xit-1$

Where IN stands for innovation (and type) and X are a set of covariates. For the purpose of this study we differentiate between product and the other three types of innovation, which we referred to as productivity enhancing innovation based on the assumption that any of these should increase efficiency either in production or the distribution of the goods offered by the firm. Any of those forms of innovation should allow firms to provide more with the same resources because the output requires less input, workers produce more, or the consumers face less hassle to find the product. Our first preliminary results are for the fixed effect model and for the estimations using instrumental variable techniques and generalized method of moments using as instrument a binary variable that captures whether the firm received public support shows positive effects on the level of total employment and number of skilled workers, and growth rates, while our results for the share of skilled labor in total employment are mixed.

Nevertheless, further work remains to be done: approximating the share of skilled workers on unskilled labor, performing robustness checks using other instruments, merging the Innovation Survey with the Economic Survey to check for changes in wages and not only in quantities, and estimating total factor productivity to use as a control and to check the effectiveness of process enhancing innovation.

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