



SKILLS, TASK, TECHNOLOGY AND EMPLOYMENT

Analysis of Technology's Impact on Skill-Task
Allocation and its Distributive Affects

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Abbreviations

CSC	Capital-Skill Complementarity
EU	European Union
RBTC	Routine-Biased Technological Change
SBTC	Skill-biased Technological Change
OECD	Organization for Economic Co-operation and Development
US	United States
UK	United Kingdom

1. Introduction

As technology shapes the economy, the products we consume and produce change, and this change influences the relative demands of factors of production. Economists put enormous effort to characterize this effect and its implications on different subsets of the labor force to understand the observed patterns in the distribution of earnings and skill premia.

My initial research revealed that economists discuss the characteristics of technical change within three economic hypotheses which are used to examine the interactions between workers and machines, namely skill-biased technological change (SBTC), capital-skill complementarity (CSC), and routine-biased technological change (RBTC) (Goos, 2018).

SBTC suggests that technological progress augments the labor productivity of skilled workers more than unskilled workers, thereby increasing the demand for skilled workers relative to unskilled workers, increasing demand for skilled labor, and elevating the skill premium. CSC assumes that capital and skill are relative complements, so capital deepening increases the demand for skilled relative to unskilled labor, increasing the skill premium. RBTC posits that technological progress replaces workers doing routine tasks, and self-selection of workers with different skill levels occurs.

While technology evolves the demand structure for different factors in production, the labor market faced several developments which I want to put emphasis on in this research.

Job-Polarization can be defined as the increase in the relative demands for high and low-skilled occupations accompanied by a sharp decline in the demand for middle-skill occupations. Katz and Autor (1998) found that there was a compression of skill differentials and wage inequality in most industrialized economies during the 1970s, followed by a rise in differentials in the 1980s, with the highest increase seen in the U.S. and U.K. Atkinson, using data for 19 OECD countries, reports that there was a rise in either upper-tail or lower-tail inequality in 16 countries between 1980 and 2005, with seven countries experiencing a rise in both tails.

Off-shoring is another development that the modern economy experienced with the ever-globalizing world. based on the findings of Autor, Levy, and Murnane (2003), the emergence of new technological advancements has made it possible for information and communication technologies to take over or facilitate the outsourcing of specific essential job tasks formerly carried out by middle-skilled workers. Consequently, this has led to a significant alteration in the benefits of skills and a noticeable change in the way skills are assigned to various tasks.

All the defined technological change hypothesis has been argued and tested by economist to fit observations in the labor market mentioned above, though I am going to focus mainly on the SBTC hypothesis, particularly discussed and implemented in the production and labor economics framework suggested by Acemoglu and Autor (2011), and potentially RBTC via participation of capital in the production of tasks, to investigate clues for job polarization and Off-shoring (and potentially automation).

The research question to answer is:

How did the recent developments in technology affect the skill demand in advanced Economies and to What extent these effects can be classified as results of Off-shoring (and potentially automation)?

The aim of this study is to explore the implications of Acemoglu and Autor's skill-task framework on the current task-skill allocation in OECD countries. The study will employ econometric models to test for clues for offshoring (and/or the potential for automation) in order to compare the results with van Welsum and Reif's (2005) analysis of offshorability. This will allow for an assessment of the extent to which the two methods of analysis converge or diverge in their findings. The econometric models will be estimated using panel data techniques, and the results will be interpreted in the context of the existing literature on trade, technology, and employment.

This paper will proceed as follows: Chapter 2 summarizes the literature. Chapter 3 introduces the Framework to be Utilized. Chapter 4 analyzes the comparative outcomes of the framework and chapter 5 introduces the data. Chapter 6 discusses the results of the empirical estimation. Chapter 7 concludes.

2. Literature Review

2.1 Technology and Labor Market

The first stepping stones for modeling the relationship between technology and heterogeneity on labor earnings was mentioned by Tinbergen (1974, 1975) as the concept of a competition between the demand for and available supply of education, where technology plays a significant role in determining the demand.

The idea of a competition between the need for and availability of skills (education), where technology plays a crucial role in determining the demand, was later popularized by various economists aiming to explain the alterations occurring in the labor market and the distributive effects of the fundamental technology characteristics shaping the demand.

The literature on the topic of the relationship between education and wages starts with the observation that despite the increase in the number of college-educated workers, the relative wages of college graduates compared to high school graduates have also increased over time. This suggests that the demand for skills, alongside the supply of skills, has also increased.

One of the significant perspectives explaining the role of SBTC in wage inequalities was defined through the process of computerization. It is argued that the introduction of computers into the workplace has led to a shift in demand for different types of labor (Autor, Katz and Krueger 1998). Specifically, SBTC is closely related to computerization as computer technology has advanced, it has become more important for workers to have strong technical and analytical skills to remain competitive in the labor market.

Another widely accepted and appreciated approach was developed by Katz and Murphy (1992) to explain the observed increase in the wage gap between skilled and unskilled workers in the US between 1963 and 1987. Their analysis revealed that changes in the relative supply of skilled and unskilled labor had a modest effect on wage inequality, while the skill-biased technical change had a significant impact on the demand for skilled workers and therefore on the wage gap.

The Katz and Murphy framework, referred to as the “Canonical Model” in Acemoglu and Autor (2011), includes two skill groups performing two distinct yet imperfectly substitutable occupations (or producing two imperfectly substitutable goods). Technology is assumed to take a factor-augmenting form, and thus enhances either high or low-skill workers' abilities and SBTC is captured by changes in this factor-augmenting technology.

2.2 Skills, Tasks, and Occupations; Beyond Canonical Model

While the Katz and Murphy framework has also proved to be empirically successful in explaining the relationship between technical change and earning distribution (Katz and Murphy, 1992; Autor Katz and Krueger, 1998; Riddell and Romer, 1998), critics of certain attributes of the model have raised and generated further modifications on explaining 21st-century phenomena happening in the labor market. One study focusing on the phenomena of 21st-century US Labor markets, namely “automation”, “offshoring” and “job polarization”, was proposed by Acemoglu and Autor (2011).

Before Diving into further explanations, I believe it is convenient to provide certain definitions regarding the framework environment inherited by Acemoglu and Autor (2011).

A task is defined as a “Unit of work activity that produces output (goods and services)”. In contrast, a skill is defined as a “Worker’s endowment of capabilities for performing various tasks”. Labors apply their skills to tasks in exchange for labor income, and skills applied to tasks produce output.

What Acemoglu and Autor prosed was to add another layer of assignment (replacing skill-to-output mapping with skill-to-task-to-output mapping) to explain the impact of technological changes on employment and wages through changes in the allocation of skills to tasks. Another modification proposed by Acemoglu and Autor was to add a middle-skilled cluster of labor and introduce further segmentation of the labor force to investigate job polarization.

Furthermore, in Acemoglu and Autor's framework, the authors defined technological change as an endogenous variable to explain the time-varying behavior of SBTC. In contrast, the canonical model treats technology as exogenous and assumes that technical change is “by its nature” skill-biased. However, evidence suggests that the degree of skill bias of technical change has differed over time and across countries. Acemoglu (1998, 2002) proposed that the endogenous response of technology to labor market conditions may explain several of these patterns and considerably enhance the canonical model.

2.3 Methodology

Welsum and Reif (2005), use panel data estimation techniques to examine factors associated with the share of employment potentially affected by offshoring in the US, Canada, Australia, and EU15 countries (excluding Greece, Ireland, Luxembourg, and Portugal) between 1995 and 2003. The model includes variables related to trade, investment, industrial structure, technology adoption, product market regulations, employment protection, and human capital. The chosen variables are based on previous research on the service sector, service sector employment, and the impact of trade and technology on employment.

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