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James Bessen, *Learning by Doing: the Real Connection between Innovation, Wages, and Wealth*, Yale University Press, 2015, 293 pp. \$35 Hardcover.

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Abstract. Across most industries, workers feel the effects of automation. Does innovation permanently replace workers or are they temporarily displaced within firms and labor markets? James Bessen's book *Learning by Doing* combines theory and economic history to illustrate and inform readers and managers alike concerning modern labor markets.

Keywords. Wages, Wealth, Innovation.

JEL. E21, E24, J30, O10, O30.

1. Introduction

In 2008, US and international economies stood on the economic precipice. Faced with declining profits and bleak prospects, firms laid-off 2.6 million workers to remain profitable; the unemployment rate reached 10.1 percent. Eight years later, the unemployment rate is again below 5.0 percent. The recent crisis, while dramatic, has proven yet another example of how markets and workers adjust to changing economic circumstances. It is against this backdrop that James Bessen skillfully uses the lessons of economics, history, and culture to synthesize labor market conditions over the long-run in *Learning by Doing: The Real Connection between Innovation, Wages, and Wealth*. Rather than just offering a colorless, mechanistic view of the path from innovation to real wage increases, this book offers rich historical detail. For example, Bessen relates how complementary innovations in steam, textile production relocation to urban areas, factory uniformity, and the development of teachable worker skills all played key roles in changing labor market conditions.

The book's strength is its comprehensive view on the relationship between employment, technological change, and what we learn from it as contemporary labor markets go through similar changes. For the most part, labor markets match workers to firms, and earnings reflect education, job-market experience, and alternative choices. Without significant disruption, labor and output markets generate sufficient opportunity to remain near full employment. However, there are economic shocks that disrupt markets and throw labor markets into turmoil. Bessen takes the long-view of economic history to address pivotal episodes in economic development and labor market variation. Nineteenth century philosopher Karl Marx's proposed that new technologies permanently replaced workers when capital no longer needed labor. When physical modes of production outstrip social modes, revolution follows and creates a reserve army of the permanently unemployed. According to Marx, these disruptive technologies reduce the demand for labor and

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put workers at a permanent disadvantage. However, Bessen's more positive and comprehensive view uses rich historical examples to illustrate how new technologies displace workers from some specific tasks, but they also increase demand in other tasks or industries. Take for example bank tellers. When automated teller machines (ATMs) were introduced, it was predicted that the roll of entry-level tellers would quickly become superfluous, unnecessary, and expendable. However, 30 years after the ATM's introduction, the demand for entry-level bank-tellers remains strong. Why? According to Bessen, like entry-level jobs in other industries, the direct effect of the introduction of ATMs was to replace entry-level tellers with low cost machines. However, the indirect effect-frequently over-looked-is that the decrease in demand for bank tellers per bank is offset by the corresponding increase in the demand for tellers when the relative cost of opening a new branch decreases, thereby, increasing the overall demand for tellers because more branches are opened. In sum, the net benefit to labor innovation is positive, but workers must adapt to changing circumstances.

When new technologies are introduced into labor markets, it is educated workers who are most productive and in high demand. However, demand for workers with standardized skills increases once labor markets assimilate skills that interact with new technologies. While wages in these new technology industries eventually catch-up, existing wages can lag for lower skilled workers until standards are developed. For example, Bessen uses the late 18th and early 19th century textile mills in the northeastern US. While male field hands continued to have opportunities in agriculture, women were the first to occupy the mills, and it was educated, adept young women with capacity and dexterity-frequently associated with education-who had ready access to employment opportunities. Of the female mill operatives who skillfully adapted, increasing demand for their skills eventually bid up their wages. The over-arching principle is that when new technology-related skills are introduced into the labor market, skills can be difficult to acquire, and many workers do not benefit from their existing skills. However, they must be trained through standardized methods that take time to develop and imbed.

Since most job related skills are developed at work, formal education is not requisite for labor market success. Nevertheless, education is useful in adapting to changing technologies because educated workers have 'learned how to learn.' It is this adaptability that is valued in labor markets. When new skills are acquired and standardized, trade and licensing bodies arise to provide signals of minimally qualified skills possessed by workers. However, economic theory and fact illustrates that these skill-accrediting bodies can also serve as barriers to economic opportunity and product development. Still another dimension of Bessen's analysis are trade secrets and patents. Joseph Schumpeterian proposed that patents are vital for economic growth and product innovation. Like Michele Boldrin and David Levine, Bessen illustrates that most of these trade secrets and patents serve to distort growth and prevent product development rather than encourage it. An example is Silicon Valley and Route 128 in Boston. In the 1970s, computer industry do-not-compete agreements were rigidly enforced in Boston, whereas these agreements were not rigidly enforced in Silicon Valley and the Bay Area. This skill portability allowed programmers and early computer innovators in the Bay Area to ply their skills shortly after separating with technology and computer related firms, while strict adherence to Boston's do-not-complete agreements distorted its growth and labor market development. Boston has lagged behind the Bay Area, yet is showing signs of improvements as they now replicate less rigid do-not-complete arrangements. Entrepreneurs also under produce knowledge-based technologies, and early barriers to knowledge in technology-related industries can distort rather than promote market extension and product development.

There are questions that are not answered in the book. Skill standardization takes time and involves considerable start-up costs. While teaching standardized techniques has scalable elements, does teaching standardized techniques offset

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expanded knowledge required to master a discipline? For example, limited scale may exist in educating and training engineers, but engineers must acquire and master existing techniques that have existed in an industry over generations, while simultaneously preparing workers in existing skills that are portable for future techniques. It is also not clear what the threshold is between developing and developed industries where patents are economically beneficial. Nonetheless, James Bessen's *Learning by Doing* is a valuable contribution to business managers, historians, and economists alike.



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