Book Reviews

Edited by Robert Herren

Innovation and Inequality: How Does Technical Progress Affect Workers? GILLES SAINT-PAUL. Princeton, N.J.: Princeton University Press, 2008. Pp. xiv, 190. $50.00.

Gilles Saint-Paul provides a rigorous treatment of how technical progress contributes to income inequality. Unlike many scholarly books that discuss income distribution at a more general or policy level, Saint-Paul examines the microeconomic foundations of how technical change affects the labor market using a variety of mathematical models that are supported by a variety of assumptions aiding in the generation of mathematically tractable predictions. Comparative static results are derived to show short-run theoretical results while dynamic specifications are presented to illustrate the long-run impact of technical change on the growth path. Shorter mathematical proofs are in the text while longer proofs are relegated to appendices.

Neoclassical models view labor as a homogeneous or "quantity" input. Each worker is endowed with some combination of strength and intelligence. Because many labor markets cannot be adequately described this way, Saint-Paul offers another view of labor as a "quality" input. This view identifies labor as a unique input that is not easily reduced to a vector of interchangeable characteristics.

Interestingly, the degree to which the distribution of income responds to technological change depends on whether labor is specified as a quantity or quality input. The nature of technological progress is also important. Technological improvements are summarized in an exogenous variable in many production functions. However, if technology is specified as an endogenous variable, that is, as a function of learning-by-doing, Saint-Paul describes two kinds of innovation. Horizontal innovation increases the range of available goods and may benefit wages more than profit. For example, with a given amount of capital and homogeneous labor, technological change that is capital augmenting would improve worker wages under the assumption labor and capital as complementary inputs. Vertical innovation increases total factor productivity (TFP) in existing goods and may benefit profits more than wages. Here, Saint-Paul shows that if technological advance is labor augmenting, it leads to two opposing effects. Labor augmented technical

change endows each worker with more "labor" in efficiency units tending to increase wages. However, a higher labor/capital ratio moves labor down its marginal product (MP) curve tending to reduce wages.

As an extension to the neoclassical model, Saint-Paul introduces heterogeneous labor specifying both skilled and unskilled workers. One result of these models is that if technological change is biased in favor of skilled workers, the relative and absolute wage of unskilled workers will fall. In this case, advances in technology complement skilled workers and substitute for unskilled labor.

The author provides empirical evidence for the rise in income inequality and attributes it to the change in input mix. Specifically, the source of the increase in income inequality begins with improved technology for producing capital goods rather than the production of final goods. The skill premium and its impact on income inequality is the joint result of the technology driven fall in the relative price of capital goods and their complementary relationship with skilled workers in the production of final goods.

Firms may simultaneously use old and new technologies during transition phases. Saint-Paul shows that in certain circumstances some workers may see a decline in wages with the introduction of new technology. Those workers who continue to use old technology will have fewer complementary inputs reducing their productivity and wages. This result can be reinforced if learning the new technology is viewed as costly. However, if technological change is "de-skilled", learning costs can be lower reducing income inequality.

Supply side effects can also affect the distribution of income. As more skilled workers enter the labor market, they can induce firms to adopt new technologies and organizational methods that are intensive in skilled labor utilization. To the extent that productivity improvements result from technological change, the resulting greater supply of goods and lower prices benefit both skilled and unskilled workers.

An interesting example of labor as a quality input relates to the "superstar" case. Information technology has a powerful affect on the distribution of income when it comes to superstars relative to "second best" workers. For example, a major league basketball player may not be easy to replace. Higher ranked leagues composed of teams with superstars are more widely broadcast because information technology has a multiplier effect increasing the superstar's value in the marketplace. Unlike basketball superstars, physicians may experience upper bounds on earnings because of decreasing returns to scale. This constraint, however,

is loosening because information technology related to the internet is allowing physicians to consult with patients world-wide.

Another source of income inequality relates to the "assignment problem". This describes how workers match with each other in firms and their position in the hierarchy. The author proposes models of segregation with the observation that highly skilled workers team with highly skilled workers and less skilled workers team with less skilled workers. If two highly skilled workers are assigned to complementary tasks, then through their interactions their marginal products will increase simultaneously. Segregation may insulate the unskilled worker from skill biased technical change by suppressing the unskilled worker's interactions with skilled workers further depressing wages of unskilled workers. Also, the return to skill should be higher as one ascends the hierarchy because a greater span-of-control is associated with a larger impact on total output. Different income levels demand different types of goods in the product market. For example, high income earners may demand increasingly sophisticated goods. Factor markets respond by increasing the relative demand for creativity. The resulting increase in TFP can lead to an increase in the relative wage of skilled versus unskilled workers accentuating income inequality. However, as new goods are introduced, markups decline over time which reduces income inequality.

Saint-Paul emphasizes that imbalances between productivity growth in physical goods and the R & D sectors can also generate income inequality. However, in the long run, as long as capital can accumulate, technical progress should not be redistributive. Any rise in inequality is likely to be temporary as new technology becomes easier to use and is diffused throughout the economy.

In summary, Saint-Paul provides a variety of models with predictions of how technological change affects the labor market and in turn, income inequality. The mathematical exposition of the models presented gives precision to his discussion and requires careful reading. Graduate students in Economics at the Master's level and economists with a background in mathematics should be able to follow most of Saint-Paul's arguments. This book would be a nice complement to a graduate course in labor economics or as a reference.

JEFFREY G. WOODS

University of Indianapolis