



“Summary of article by Stephen Machin, Annette Ryan, and John Van Reenan: Technology and Changes in Skill Structure: Evidence from an International Panel of Industries” in Frontier Issues in Economic Thought, Volume 5: The Political Economy of Inequality. Island Press: Washington DC, 2000. pp. 217-220

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The growth of inequality in wages in recent years is to some extent associated with changes in the structure of skills. Whether defined by occupation or education, or measured by their share of employment or their share of the total wage, workers with higher skills have become a larger proportion of the economies of industrialized countries. The difference in wages between higher-skilled and lower-skilled workers increased in the United States and even more so the United Kingdom. In several European countries, unemployment rose, accompanied by employment shifts that adversely affected less-skilled workers. There is a great deal of debate about whether these changes result from the spread of new computer technologies, global trade patterns, or changes in labor market institutions.

This paper examines four countries where comparable data is available over a number of years from the 1970s and 1980s: the United States, the United Kingdom, Denmark and Sweden. The authors find evidence that technological change shifted demand toward higher-skilled workers in each of these countries. However, labor market institutions had an important influence on the extent to which less-skilled workers suffered wage declines or increasing unemployment.

Changes in the Skill Structure of Industries

Several influential studies have claimed that technological change in the United States is a major factor in the polarization of wages. According to this argument, new technologies are skill-biased, that is, operating and managing these technologies requires high levels of skill. Demand for skilled workers increases and their wages rise. Low-skilled workers, on the other hand, are left behind by new technologies. Demand for their labor decreases and their wages fall.

In order to test the skill-biased technological change argument, this paper compares data on changing skill structure in the United States with comparable data from the United Kingdom, Denmark and Sweden. The data, drawn from merged OECD and UN sources contains information over a 17 year period on wages, production and non-production employment, R&D expenditures, value added, investment, and trade for 16 manufacturing industries in these four countries. (Non-production employment is often interpreted as a proxy for skilled labor.) As a check on results from this dataset, surveys in the U. S. and U.K. contain information on education as a measure of skill. The alternate U.S. and U.K. data also allow analysis of all

industries, not just manufacturing, and of computer use to substitute for R&D as a measure of technology.

Between 1973 and 1989 the non-production shares of both the wage bill and employment in manufacturing rose in all four countries that form the basis of this study. Decomposition of the change in shares between production and non-production workers indicates that by far the greatest part of the change in all four countries - for both employment and the wage bill - occurred within rather than between industries. In the U.K., almost 90% of the increases in the non-production worker share in both employment and the wage bill happened within industries; in the U.S. and Denmark, over 80% of these changes were within industries. In Sweden 73% of the change in the wage bill share and 68% of the change in the employment share was within industries. A number of researchers highlight within-industry change in skill structure as an indicator of a possible technological cause.

Before incorporating direct measures of technology, however, some methodological problems with the four-country analysis should be noted. First, some analysts consider education to be a more appropriate measure of skill. Second, the large and growing service sector is not included. Third, the industries are highly aggregated, which may account to some extent for the large amount of within industry change.

The four-country dataset was not comprehensive enough to address these issues, however, suitable data for the 1980s from the U.S. and U.K. produced similar results: the share in employment of workers with low educational attainment (high school or less) fell in all industries as well as in manufacturing. The share of workers with medium (some college) and high education (college graduate) rose. For both aggregated and disaggregated industries, the changes overwhelmingly occurred within rather than between industries. The largest changes occurred in the same industries across all four countries, further indicating the presence of structural change.

Changes in Skill Structure and Technology

A time series model was developed for the four-country data using the ratio of R&D to value added as a measure of technology, and production vs non-production worker shares as a measure of skill. The results make it clear that higher skills are associated with new technology in all four countries. Similar, but somewhat less decisive results were obtained with the alternate U.S. and U.K. data using education as a measure of skill. R&D generally has negative effects on the wage and employment shares of the least educated group and positive effects on the most educated, however, in the U.K., the effect for the highly educated is not statistically significant. The U.S. and U.K. also allow examination of computer use as a technology variable. Neither R&D nor computer use is a perfect measure of technology, but the two measures are highly correlated. Substituting computer use for R&D in the regression analysis also produces evidence of skill-biased technical change.

Implications of Cross-Country Variation

Despite the similarities in the patterns of change in the skill structure of the four countries analyzed above, the amount of change in each country that can be explained by the change in technology varies. In Sweden, 83% of the increase in the share of the wage bill for higher-skilled workers can be attributed to the R&D effect; in Denmark 39%, in the U.S. 27% , and in the U.K. 19%. “It is interesting that, in the country with the least institutional change (Sweden), technology appears to do a good job at accounting for shifts in the skill structure. By contrast, in the country which has (arguably) experienced the most institutional change (the U.K.) technical change makes the smallest contribution.” [22]

The inability of the skill-biased technological change hypothesis to offer a complete explanation for changes in the skill structure raises questions about other possible explanations. Foreign competition is another explanation favored by several researchers who argue that low-skilled workers in industries with increasing trade deficits are at a competitive disadvantage. However, when added to the regression analyses performed for this study, trade effects were insignificant in three countries. There is weak evidence that import intensive industries in Sweden suffered a faster shakeout of low-skilled workers, consistent with evidence that between industry change was somewhat larger in Sweden than the other three countries. Still, the R&D effects were strong in all countries even with the addition of trade-related variables.

The other explanation for changes in skill structure, hinted at in the comparison of Sweden and the U.K. mentioned above, is institutional change, specifically changes in union membership. From 1973 to 1989 union density in the U.S. fell steadily to 15%, in the U.K. rose through the late 1970s then fell to 42%, in Denmark rose through the late 1970s then leveled off at 80%, but in Sweden rose to over 90%. Because union coverage in Sweden is almost universal, distinctions across industries cannot be made. For the other three countries, however, analysis of manufacturing industries indicates that “the degree of change in the skill structure is relatively slower where unions have greater influence in wage setting.” [26]

It may be that unions are able to achieve a higher skilled/unskilled labor mix than employers prefer, or unionized industries may have better opportunities for training than other industries. Rather than simply serving as a proxy for wage rigidity, unionization seems able to mitigate the effects of skill restructuring for low-skilled workers.