Fear the Machine?

The use of advanced automation and artificial intelligence continues to expand across countless industries. However, concerns over recent labor market movements have challenged the traditionally optimistic view of our increasingly 'roboticized' future.

How do the technological changes caused by increased automation and A.I. affect workers' wages and jobs? In PERC working paper 1801, PERC's Director Dennis W. Jansen and co-author Michael D. Bradley study the effects of automation and artificial intelligence on employment and labor income over multiple generations.

The decline of real median income in the U.S. isn't a new phenomenon. U.S. real median income grew rapidly for twenty years after 1953 and experienced growth, although at a slower rate, through the 1980s and into the 1990s. In 2000, real median income peaked, then stagnated until 2016 when it reached $70,707. Since the turn of the century, the compound growth rate has also been stagnant, achieving only 0.18% annual growth.

Since labor income is the dominating factor in median family income, this is a reflection of declining payments to labor. In addition, the labor force participation rate is also declining. Although these downward trends may be caused by numerous reasons, new studies suggest that advanced automation may be a contributing factor.

Research focused on 'robot' technology and its effects is still in its infancy and little commonality exists in terms of the framework used

> **"The traditionally sanguine view of the impact of technology on wages and employment is starting to be questioned."**

to gauge the influence of advanced automation.

A previous model in which automation requires no labor in the context of an overlapping-generations model with two technologies found that increases in productivity in the robot sector can lead to declines in output, wages and employment economy-wide.

Likewise, in another model where automation capital is a perfect substitute for labor, as automation capital increases, wages fall as robots substitute for labor leading to lower labor income. Prior research models differ in how output is defined, labor's relationship to capital, and the number of technologies used.

In this paper, the authors bridge the gap left by previous research by studying the potential impact of automation using two versions of an overlapping generations model. The first version investigates automation using a single production technology in which the share of output shifts from favoring labor to favoring capital.

The second version allows the robotic sector to compete for capital and labor with the traditional technology sector by analyzing two separate technologies and where both traditional technology and robot technologies compete for labor and capital.

The two versions incorporate an overlapping-generations model which includes a 'young' and an 'old' generation that captures the effects of automation within each generation and across all generations as a whole.

Labor earnings of the young generation fund consumption and savings. Savings take the form of capital, either traditional capital or robots, depending on which version is being analyzed. Capital is then used to generate income to fund consumption by the old in the next period. The key feature of the model is the effects

of the young generation's saving on the next generation. A reduction in earnings not only creates lower consumption, but also lower capital for future periods.

The model is then used to gauge the ability of tax policies to mitigate negative effects caused by the use of robotics. A labor subsidy is introduced and the subsidy rate is set to exactly offset the changes caused by the declining wage rate, thus keeping the after-tax wage constant. The labor subsidy is paid for by a tax levied on traditional and 'robot' capital.

Results show that as society adopts newer and more capital intensive technology, the equilibrium impact can result in lower wages and lower savings of the younger generation. These effects continue until the less-capital intensive technology falls into complete disuse. After this occurs, the increase in productivity

of the more capital intensive technology produces the expected effects – a rise in both wages and capital. In order to maintain the income of the young during this transition, a policy of subsidizing labor can mitigate the decline in the capital stock and thereby mitigate the negative economic impacts.

Both versions raise concerns over the possible implications of automated production technologies on employment and labor income. Shifting to technology that uses a limited amount of labor can potentially lower wages and labor income during the transition period.

This remains true even when using a moderate definition of robot automation: a rising capital share in a traditional technology, as well as in the second version, where technology is in competition and requires little to no labor.

The Effect of Own-Gender Juries on Conviction Rates

From the time of the Magna Carta, it has been guaranteed that, "no man be punished without the lawful judgment of his peers." Today, this central right to an impartial jury of our peers is enshrined in the 6th Amendment of the Bill of Rights. The right to an impartial jury is the cornerstone of the U.S. justice system, but are these juries truly impartial, or do they favor defendants who are similar to themselves?

From PERC working paper 1803, PERC's Rex Grey Professor Mark Hoekstra and co-author Brittany Street study whether gender matches between jurors and defendants affect criminal conviction rates.

As a result of concerns over the impartiality of juries, previous court rulings have established that potential jurors cannot be prohibited from selection on the basis of race, ethnicity, or sex. Despite these precedents, recent research has documented bias where jurors favor defendants of the same race as themselves. However, little research has been explored when it comes to the bias of jurors toward defendants who are the same gender as the jurors.

The main obstacle to conducting research on juries is that the jurors are not randomly selected. The authors' study is based on data from

Florida. In Florida, local residents who hold registered state identification are summoned to the court randomly by mail and each is randomly assigned both a number and to a case. Each potential juror for a given case is then questioned by both the prosecutor and defense attorney to bring to light biases the jurors may have.

During questioning, known as voir dire, either attorney may attempt to strike a juror, which if successful, is granted by the judge. Each side is also allowed three peremptory challenges to remove jurors they believe are unlikely to favor their side of the case. The final

jury consists of the first six or twelve jurors not struck by either side, beginning with the juror assigned the first number.

Although the jury selection process begins with random selection, it is significantly influenced by defense attorneys, prosecutors, the judge and the potential jurors, themselves. As a result, cases with, for example, an especially talented defense attorney may have more same-gender jurors than a case with a public defender. This makes it difficult to distinguish between the effect of juror gender and the effect of other factors like defense attorney quality.

To overcome this selection problem, the authors use randomization of the initial juror pool and the random ordering of jurors within that pool to predict the proportion of females that serve on the jury. With this method, the authors are able to estimate effects using only the variation in jury gender composition that occurs randomly, rather than the variation that is caused by attorney quality or other confounding factors. The authors show that while the predicted gender composition of the jury is strongly predictive of the gender composition of the seated jury, it is not related to other case and defendant characteristics.

The data includes juror characteristics and conviction and sentencing outcomes for all felony and misdemeanor trials, as well as guilty pleas, from 2014-2016 from the third and fourth most populous counties in Florida, each with a population of over 1.3 million people. Detailed information on defendants, case characteristics at charge and trial levels,

potential juror genders, and the randomly assigned ordering of each potential juror within the jury pool is used. The authors then ask whether having a jury with more (randomly assigned) opposite-gender jurors leads to higher conviction rates and longer sentences.

Results show that jurors exhibit significant gender bias for cases involving drug charges. Estimates indicate that a 10 percentage point increase in the expected own-gender composition of the jury results in a 19 percentage point decline in conviction rates on drug charges and a 13 percentage point reduction in the likelihood of being sentenced to

> **"A central right of the accused in the U.S. criminal justice system is the right to a trial before an impartial jury"**

at least one day in jail. This highlights the important role that jury gender composition has on the outcome of drug cases, independent of the underlying facts and evidence in the case.

By comparison, the authors find no evidence of gender bias by juries for property or violent crimes. They hypothesize that the difference in jury bias across crime types could be due to Americans' views on the enforcement of drug crimes compared to property and violent crimes. While public opinion is largely sup-

portive of the prosecution of property and violent crimes, there is significant opposition to the prosecution of drug possession. This is reflected in a recent Gallup poll that nearly two-thirds of American adults favor the full legalization of marijuana. This aligns with the study's findings: while jurors can and do convict opposite-gender defendants of breaking laws with which they disagree, they are much less likely to convict own-gender defendants of the same crime.

The results of this study highlight that even in a setting where the necessity of being fair and impartial is actively pressed upon participants, sizable in-group biases can still occur. This suggests that prosecutors and attorneys have a strong incentive to strike jurors from the juror pool on the basis of gender, at least in the context of drug cases. This provides support for recent U.S. Supreme Court cases in which the court has ruled this practice to be unconstitutional, and suggests an ongoing need for oversight by the judge to ensure fair trials.

In addition, the results have important implications for the long-run outcomes of defendants. Previous research has shown that increased conviction and incarceration rates lead to increased recidivism and worsened labor market outcomes. As a result, the findings of this analysis show that drawing a jury with more opposite-gender jurors imposes significant long-run costs on defendants.

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