Athens State University Economic Updates

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This publication is provided as a service by the Logistics, Technical, and Programmatics Institute (LTPI) at Athens State University and concentrates on providing access to the expertise and research capabilities of the University's College of Business to government and businesses. The University publishes an annual update to provide data and information on the economy of north Alabama and to assist the professional community to quickly respond to a growing global demand from a cross-section of businesses. Our faculty are leading efforts with both government and business agencies to provide economic impact assessments, marketing analysis, employee climate surveys, training, and personnel growth, and we stand ready to assist with your requirements.

We Need a Bigger Boat by Dr. Thomas Pieplow

When Martin Brody caught a glimpse of a monster shark in the movie *Jaws*, he famously tells the boat captain, "You're going to need a bigger boat." I was reminded of that quote after reading through a recent study published by the Oxford University Engineering Sciences Department that reflects the tsunami of change beginning to crest the workplace as a result of artificial intelligence (AI), algorithms, and robotics. Researchers reviewed 702 occupational categories, estimated the expected impacts of continued computerization/ automation, and their analysis warns that 47% of all jobs performed today will either be eliminated or radically restructured. Evidence further reflects that the market is seeing a paradigm shift where projected wages and educational attainment now exhibit a strong negative correlation with an occupation's probability of computerization.

Machines replacing traditional labor has been part of the human landscape for over 3 million years. Whether it was the wheel invented in 3,500 BC, the wheelbarrow in 118 AD, the lightbulb in 1874, the personal computer in 1970, or the advances in AI and robotics today, humans will continue to develop technologies to make life easier. These inventions made us more efficient and mean we do not have to expend as much effort working to survive. The common denominator discovered is that as we become more advanced, human labor will NEVER be cheaper.

A recent survey conducted by an international software firm revealed that over 43% of U.S. respondents had "no idea" what AI was about, with much due to confusion because AI, machine learning, and deep learning are often incorrectly used synonymously. With AI, data is examined in order to quickly deliver analytical outcomes to users. An example would be an application used by traffic engineers and planners delineating major traffic congestion points in the city that assists them in planning for road repairs, stop lights, and planning for infrastructure investments that best relieve congestion in certain areas. With "machine learning," raw data is not only analyzed, but screened for any "patterns" that could yield further insights. Following the example cited earlier, machine learning would notice that the traffic at certain intersections is most congested in the morning between 6-8 a.m., or that traffic gets congested on evenings prior to a sporting event. Now traffic planners and engineers can plan not only for traffic snarls but also for future events like concerts and football games. Then with "deep learning," data analysis and patterns are subjected to advanced algorithms developed by data scientists asking further questions related to the data to yield richer insights. Traffic planners and engineers could add algorithms to their analysis that include areas experiencing the greatest population

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The Economics of Disaster by Dr. William Wilkes

As I tuned into this morning's news, I watched the President get onto a plane headed for Alabama. Once again, this state has lived up to its name of "Tornado Alley." The National Weather Service has reported significant damage to the Lee County area with loss of life of 23 people. The EF4 tornado, with its 170 mph winds, affected people and businesses in ways from which they may never be able to recover.

Dr. William Wilkes
Professor of Economics

According to Lee County's coroner, Bill Harris, economic resources have been overwhelmed with both direct and indirect losses. The direct losses have involved the destruction of physical assets. The indirect losses involve businesses having difficulties selling merchandise. These indirect losses are especially devastating because they are not generally covered by insurance unless premiums have been paid to cover these losses.

In addition to the economic devastation of tornadoes, the social impact must be considered. Children exhibit significant sadness, anxiety and withdrawal. Adults also suffer emotional casualties which require evacuation and property damage repair. Their economic and social development needs are incalculable.

How do communities and neighborhoods recover? How can people prepare for disaster management? "These questions involve economic development and concerns," says Tyler Cowen, Professor of Economics at George Mason University, "as we make efforts to reduce the economic and social impacts with tornado warnings, tornado watches and

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"Safety is a luxury which can be consumed in greater quantities by the rich."

safe rooms as mitigation efforts."

We also support research projects between governments and universities with VORTEX (Verification of the Origins of Rotation in Tornadoes Experiment) being one of the more famous projects. VORTEX was involved with the first use of Doppler radar by the National Weather Service.

A question of concern may be the relationship of richer societies and the economic ability to provide safety. Safety is a luxury which can be consumed in greater quantities by the rich.

We should also consider the impact of charitable assistance in the face of tornado fatalities. The Red Cross is on the ground to help with home loss, homelessness and empty slabs where homes used to stand. Currently, more than fifty Red Cross volunteers are helping people by providing relief, shelter, meals, supplies, and health services.

Disasters will continue to strike; but with the concentrated efforts of local and national government agencies, businesses and industries, public and private organizations, and individual volunteers, the sooner these devastated areas can make a full economic and social recovery.

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growth projections over the next decade or which roads will need major repairs in the next five years. As these examples reflect, AI will be a growing part of virtually every job we do, but execution must be an ongoing and tiered investment process. Then as organizations realize successes and expand their AI strategies to incorporate machine and deep learning, they will be well-positioned to thrive in this new culture.

Job displacement happens whenever there are **involuntary** job losses resulting from economic factors or structural changes to individual markets. From the beginning, workers learned to adapt—or be left behind. When bronze tools were invented, those involved with the "stone tool" market were out of work—just as the bronze workers lost their jobs when steel and iron tools were invented. The first major labor displacement was documented with the Industrial Revolution, which started in the late 1700s in Europe and continued until the mid-1800s in the United States. The first wave was industrializing the manufacture of textiles, where production was moved from homes to factories. Steam power and the cotton gin played instrumental roles in this period that ultimately resulted in millions of cobblers, tanners, and weavers being displaced from their jobs and forced to adapt.

It is my view the combination of AI, robotics, and computerization will be remembered as the reason behind the greatest realignment of labor ever experienced. The impact will be far more profound and wide-ranging, and the issues exponentially more complex, than those faced during the Industrial Revolution. This is more than a new way of doing business, as we now see corporations automate processes long believed off-limits, broadly employ sensor-based industrial monitoring, and apply algorithmic exploration to every process of life. Computer science was already helping machines perform routine tasks more quickly than humans, but when the techniques of AI are combined with ever faster computing power and the accumulation of years of digitized data, for the first time computers will "learn" the tasks humans require rather than simply doing as they are told.

The ability to recognize ourselves as we are today, to include our limitations and strengths, and then imagine ourselves in different scenarios is what has always made human beings unique and a key factor in the advances we have realized. Humans have the ability to imagine oneself in a future unrealized scenario, know the limitations, and then do things necessary to build towards that goal. Then revisiting past experiences for analysis helps us to continually learn the best response in a given situation. Place any baby in a playpen with a ball and it will immediately start learning what can and cannot be done with that ball. The baby begins learning immediately that with their arm they can throw it, with their teeth they can chew it, and with their hands they can handle it any number of ways. The baby also learns limitations, such as the degrees of freedom or finite range of motion for their arm or how the weight, size, and composition could preclude any human interactions with the ball and their hands.

This ability to learn has also been what humans brought to the labor market that machines did not. Until recently, robots had to be fed knowledge through human designed simulations, modelling, or trial and error—all extremely time-consuming—in order to learn. But in January of this year, engineers at Columbia University announced a "game-changer": robots that learn on their own and do so completely autonomously. Using a process one researcher termed as "asking a human to pick up a glass of water with their eyes closed," they built a simple robot that was only an articulated arm possessing four degrees of freedom. The robot had no idea if it was a spider, a monkey, an arm, or a random geometric shape; and the arm had no knowledge of physics, geometry, or motor dynamics. Once researchers gave power to the robotic arm, it appeared to simply flop about, but in actuality was going through hundreds of thousands of trajectory sim-

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ulations with its arm. After less than 35 hours of self-training and learning (often called "babbling" in the computer science world), the robot created a self-simulation that the arm used to adapt to different situations. When given a task to grasp objects on the ground and place them in a bin, it did so with 100% success.

For the first time, researchers have demonstrated that robots can be independent, can adapt quickly to scenarios their designers did not foresee, and can execute updated simulations based upon emerging data and information in a matter of nanoseconds. Whereas a blindfolded person could eventually find that glass of water, Columbia researchers have proven that the robot can now do the same thing—except with a degree of accuracy markedly higher and in a fraction of the time needed by humans. So when you are making strategic decisions for your company or business and realize that robots do not call in sick, get along with everyone, can work 24/7, and show up every day with the same exceptional performance and capabilities, it is easy to see why they will take over the growing list of jobs they will do better. To quote Dr. Hod Lipson, Professor of Mechanical Engineering and Director of Columbia's Creative Machines Lab, "This is perhaps what a newborn child does in its crib, as it learns what it is. We conjecture that this advantage may have also been the evolutionary origin of self-awareness in humans. While our robot's ability to imagine itself is still crude compared to humans, we believe that this ability is on the path to machine self-awareness." With a baby and the continued learning it experiences with a ball, during the course of adolescence an infant grasps his capabilities and potential with the ball, establishes those permanent (range of motion) and temporary (need additional muscle strength) limitations, and then develops and refines his ball skills to achieve a goal (i.e., play football, baseball or basketball professionally). Whereas this process takes several decades for humans, machines can now do so in a matter of days; and with continued development of faster computer chips, it will eventually be fractions of seconds.

In 1890, there were approximately 13,000 businesses in the wagon and carriage (otherwise known as horse and buggy) industry. Westfield, Massachusetts is still known today as "Whip City" because it once had more than 40 industries that made nothing but "buggy whips," a small device used to prod horses that were harnessed to wagons and carriages. Today, only Westfield Whip Manufacturing remains, producing "bats" for equestrian activities. But many of those companies survived, and some thrived, simply by remaining agile and relevant to the market needs for that "new" mode of personal transportation, the automobile. Speaking metaphorically, research projects that one out of every two workers today is likely involved with "buggy whips" and if so, what happens to them?

I ask again, where does this leave the hundreds of millions of workers facing displacement worldwide? Even with record profits last year, in late November 2018, General Motors (GM) announced plans to close five North American plants and eliminate more than 14,000 workers. At best, wages earned on the local economies average less than half of that paid by GM and its suppliers. A recent study from the Federal Reserve Board shows why cuts of this magnitude are virtually impossible for most Americans to absorb. Whether it be due to poor planning or economic disenfranchisement, 43% of Americans today do not have $400 to pay for an emergency expense and one-fourth have no retirement or pension savings. Yet the two common prescriptions for laid off workers—reeducate in order to change vocations or relocate to areas where jobs are more prevalent—are often inadequate for displaced workers. The hardest hit in GM's plans was Chevrolet's Cruze assembly plant located in Lordstown, Ohio, where over 5,400 jobs are being lost. Many find it ironic that the booming economy may also be the reason for the Cruze's demise. Originally built for customers seeking a high-mileage compact under $20,000, the Cruze proved to be highly popular. But with gasoline costs at historic lows and the economy as a whole doing well, fuel economy is not a priority with many consumers, allowing them to seek out more luxurious, but less fuel efficient vehicles.

Despite the best efforts of government to address worker displacement, its "after-the-fact" solutions rarely offer the broad-based, wide-ranging, and highly effective alternatives needed. Government plays a critical role as we face this challenge, but it comes at the front end. First, government must ensure infrastructure investments fit the needs of an AI and robotics world. With the growth of autonomous ground vehicles, continuing funding of traditional highways without consideration of their fit in this new environment may make them obsolete by the time they are ready for use. Second, we must fully fund a public education system that provides diverse and qualified graduates that will be in high demand from a global marketplace.

While government certainly offers temporary assistance for job displacement, our objective must be to understand concrete steps and actions needed so that Americans do not just survive, but thrive. There are many constituencies wielding influence on how this will eventually play out, from the local small business to the global corporations. But none hold more importance in preparing our workers than our institutions of higher education and the individual.

It has been mentioned that many governments (particularly those in Europe) recognize the danger of hundreds of thousands of skilled, yet unemployable workers with little to no hope, making wages at a fraction of that earned before. While some argue the answer resides with guaranteeing every American a job at a living-wage, family and medical leave, paid vacations, paid retirement, free healthcare and college, a recent story from the *Washington Post* shows why even these proposals would fall short to the challenge faced. When Mike Bajnok lost his $30 an hour GM job last summer at Lordstown, he qualified for the federal government's "Cadillac" retraining program, Trade Adjustment Assistance (TAA). Under this, the government covers all costs for up to two years of classes plus expenses, meaning the unemployed worker gets paid while attending school. Mr. Bajnok found a program to become a "CNC machinist," someone who can program and operate specialized heavy machinery, and he used TAA to enroll. Mr. Bajnok quit after one week. When the instructor told the 58 year old to "put in his flash drive," he realized his skills were so lacking when compared to what was needed today—he had no idea what this "flash drive" could be, let alone what it should be inserted into.

I often hear from prospective students about the many hours they "wasted" in grade, middle, and high school learning algebra. Some view these foundational

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skills as having little importance; but we need only to ask an electrical engineer writing algorithms or a logistical engineer developing enterprise level programs if they actually use algebra. Sadly, companies today are forced to look abroad for students and workers to fill positions requiring AI or robotics because, America does not have enough workers who possess the necessary skills or training. For America to be competitive for high paying jobs in today's global economy, this trend must change. Early in his tenure, President Obama announced an objective for America to produce one million more graduates in engineering and related fields. We have been in a competition many were not aware of, possibly because our recent performance has not been encouraging. Undergraduate students in South Korea are **five times** more likely to major in engineering than their counterparts in the United States. South Korea far outpaces the U.S. in the percentage of young adults possessing college degrees (63% versus 41%) while their K-12 students unfailingly outperform American counterparts on international assessments. Over 25% of South Korean college students major in engineering, as compared to 5% in the U.S.

This does not happen by coincidence, but by adherence to a well-crafted, strategic plan with discrete metrics that are regularly measured. South Korea recognized over a quarter-century ago that they possessed few natural resources and were a poor country of mostly illiterate farmers. They embarked on a strategy of "outsmarting" their more powerful competitors and transforming themselves into a high-tech powerhouse. They acknowledged the long road this would be, because they had to start at the beginning with compulsory elementary education and a standardized curriculum designed to produce students highly proficient in mathematics and sciences. My point is not to advocate we embrace the same strategy as South Korea, though many would offer that as a great starting point, but that we have a plan focused on ensuring American workers are competitive in a global marketplace. The metrics often used today to measure the effectiveness of higher education, such as graduation or student loan default rates, has little to no relevance to what students' expected outcomes are when they decide to invest thousands in a higher education. As with international students, the vast majority expect the same thing for their investment—either a new or a better job. So despite the fact a student has graduated with an exceptionally high grade point average and may be current on his loan, it has no correlation as to whether he is working in his chosen field (under-employed) or in the efficacy of spending in excess of $26,000 (average student loan amount for college graduates) for a position managing a cell-phone kiosk paying $19,000 annually. Instead of making students better at what we are doing today, we must educate workers to have an ability to employ AI, robotics, or computerization to "recreate" their existing job into what will be needed tomorrow.

Finally, everyone—from the factory worker to physician to accountant to engineer to administrative assistant—has a personal responsibility to **REMAIN** educated. Too many view higher education as a destination rather than an ongoing journey; and no matter what field we may be in, failing to remain relevant is a result of an individual's decisions. The story I shared of Mike Bajnok is sad, but will be the rule rather than the exception, as long as individuals fail to keep themselves relevant. As in Mr. Bajnok's circumstance, options are limited when one is more than a half century into life and has failed to keep abreast of fundamental elements of everyday life, such as personal computers and "flash drives." Government and institutions of higher education play a key role in enabling solutions for displacement, but both are extremely limited for individuals failing to invest in themselves. And failing to devote the time and resources needed to remain in demand across a global marketplace has implications far more ominous than ever before.