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ADDRESSING THE ACCELERATING LABOR MARKET DISLOCATION FROM DIGITALIZATION

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Background

The G-20 needs more agile governance structures to create policies that avoid a "luddite backlash" against the accelerating level of labor market dislocation caused by widespread automation due to "digitalization." The productivity benefits of digitalization will drive valuable GDP growth and will be necessary to offset the declining growth in the global labor force.[1] However, without action, certain groups will be "left behind" and inequality of income and opportunity is likely to rise, further fueling the current wave of populist political movements.

The accelerated pace of technological change will require a matching pace of policy development and execution and a level of public-private sector coordination that has not been seen outside wartime. Participating private companies will gain from both regulatory and legal certainty, and social stability.

The rise of populist movements successfully challenging the post-war consensus around globalization and free trade has been driven by a narrative of communities permanently left behind by economic and social dislocations from the increasingly free movement of labor and goods. This can be seen in the regions that voted for Brexit in the United Kingdom, from the rise of populist European parties, and in "rust belt" states in the United States that switched parties to give Donald Trump the presidency.

These movements exploit "fear of the other" by railing against immigration and outsourcing but have not, so far, targeted the hollowing out of middle-class jobs by technology dislocation. For example in the U.S. rust belt, well-paid skilled manufacturing jobs have been lost to automation and the new jobs generated since 2007 are often lower paid services jobs in metropolitan areas benefiting different racial groups. Since late 2007 there has been a gain of 9 million jobs overall in the U.S., but for white workers age 25-54 years old there was a net loss of 6.5 million jobs, while minorities gained 5.5 million jobs.[2]

Conclusion

- Current political systems are struggling to address the rise of populist movements in reaction to the dislocations from globalization.
- There will be a greatly accelerated pace of dislocation from the current wave of software driven automation, demanding a more rapid and effective response.
- Public-private partnerships including business and labor organizations at national and international (e.g., European Union) levels are the central recommendation.
- These partnerships should be supported by strong information sharing among the G-20 to address the global nature of the technology changes and the global nature of the leading private players such as Google, Facebook, Uber, Amazon, Baidu, and Tencent.
- The current pace of legal and regulatory responsiveness is quite inadequate to match the accelerating pace of technological change and dislocation.
- This mismatch constrains both the productivity benefits of digitalization and the ability to define, model, and test regulatory and economic policy changes to mitigate the attendant dislocations.
- These public-private partnerships need to provide opportunities to experiment with regulatory and economic frameworks in realistic pilots that test policy at the requisite pace. The U.S. has a long history of this kind of experimentation at the state level.

[1] "A Future that Works" p. 89-91, McKinsey Global Institute January 2017.
[2] "Where Were Trump's Votes? Where the Jobs Weren't", NY Times, 12/13/2016.

Discussion

Digitalization - Exponential pace of change:

The impact of dislocation due to digitalization is now broadening to white collar and professional jobs and is accelerating rapidly because of the exponential economics of Moore's law,[3] which observes that the number of transistors on mass-produced chips doubles every two years. Since manufacturing cost per chip changes little, this represents an exponential improvement in the cost of computer processing and enables artificial intelligence (AI) techniques such as "deep learning" by large neural networks. The latest leap forward comes from chips optimized for this AI software now being rolled out by digital leaders such as Google, Microsoft and Amazon. These "deep learning" techniques need large volumes of training data to be functional and this vital input is also growing exponentially—the total volume of data doubles every 3 years.[4] We have seen the impact of these new software capabilities in image and speech recognition, autonomous vehicles, medical diagnosis, and language translation, among many other fields.

Fixed industrial robots are pervasive, but now with new AI technologies enabling environmental awareness, robots are becoming mobile and taking on tasks like wind turbine maintenance. Costs are falling such that large Chinese manufacturing firms like FoxConn are investing in robots,[5] and robots such as Baxter are being designed to work alongside and be directed by humans without explicit programming.[6] These advanced robots apply logic to handle less structured work and are predicted in a Boston Consulting Group analysis of global manufacturing to automate 25 percent of all tasks by 2025.[7]

Other examples of the impact of machine learning include diagnosis programs that are more accurate than human radiologists and "robotic process automation" software in financial services that eliminates 90 percent of the large staffs currently processing certain compliance and mortgage documents.

Analyses of global labor market impact:

The scale of impact can be seen in Frey and Osborne's systematic occupational analysis of the potential impact across the U.S. economy, which estimates that 47 percent of jobs are at risk[8] in the next 10-20 years. Frey cites a 2013 McKinsey Global Institute (MGI) study looking at the potential impact on knowledge workers and estimates that 140 million workers would be affected worldwide. Most recently MGI's deeper task-based global analysis estimates that 49 percent of jobs are at risk from automation (*ibid*, n.1). Clearly, in many cases jobs will be partially rather than fully automated, but the impact on the volume and nature of employment will still be profound.

The pace of impact is harder to predict but will accelerate as software plays a greater role. The rollout of automation in manufacturing over the last 20 years has been constrained by the high capital costs of industrial robots. As AI software becomes the critical value element driving performance, however, we will see a dramatic acceleration in adoption. Put simply, the marginal cost of replacing a worker with a robot system in manufacturing is approximately $130,000 today (*ibid*, n.7), but the marginal cost of applying AI software to white collar work can be as little as the cost to download software into existing infrastructure. So, for example, in both the radiology and financial services examples, documents are already digitally scanned so the marginal cost of replacing a worker with AI powered software is small compared with the 90 percent productivity gains.

As these accelerating effects become evident in the broad economy there is a very real risk that populist movements gain additional strength, and, in addition to potentially reversing the benefits of

[3] "Cramming more components onto integrated circuits", Gordon Moore, Electronics Vol. 38, No 8, 1965
[4] "The Digital Universe in 2020" John Gantz and David Reinsel, IDC, February 2013.
[5] "FoxConn replaces '60,000 workers with robots'" - BBC, May 25 2016.
[6] "Rethinking the Manufacturing Robot", MIT Technology Review, April 2015.
[7] "The Shifting Economics of Global Manufacturing", Boston Consulting Group, 2015.
[8] "The Future of Employment: How Susceptible are Jobs to Computerization" Frey and Osborne, University of Oxford, 2013.

trade, they will challenge the introduction of productivity improving technology that has been an important engine of wealth creation in the modern age.

Proposed governance approach: An agile public-private sector partnership

- The pace of governmental response today is too slow to keep up with the exponential pace of modern information technology driven change. As a result major societal changes occur without a public dialogue or meaningful government involvement—at least not until after the "facts on the ground" are already established. For example, consider the global adoptions of Uber and AirBnB, which in many cases ignored local regulations.

- The structure of government response is typically driven by individual departmental agendas and fragmented between different levels of government without an overarching strategy, or consideration of the interplay between actions taken by different departments and different levels of government.

- In the existing patchwork, the private sector often lacks the legal and regulatory predictability to make large investments. Major structural changes are often driven by a few global technology companies, raising concerns about future employment at national companies that currently play a vital role in the industrial base.

- These challenges can best be addressed by a set of fast moving public-private multi-disciplinary teams, incorporating government, business, and labor. The teams will adopt best practices from industry and use an iterative collaborative approach to create comprehensive and consistent policy and regulatory frameworks, model their economic and social effects and test them in pilots.
    - These teams can learn from the agile software methodology that has swept the information technology industry over the last 15 year.[9] This agile methodology integrates all stakeholders up front and has driven better quality deliverables aligned with real end user needs.
    - The various public participants must work to conceive a holistic and comprehensive framework to meet agreed social and economic goals. The scope should include job redesign, job retraining, as well as the relevant legal and regulatory frameworks.
    - The private participants will include leading global and national industry participants, likely organized through business and labor organizations. An iterative consultative approach will identify and mitigate negative dislocations.
    - A critical characteristic of this agile approach is a rapid and iterative cycle of policy development, perhaps a biweekly cycle delivering an integrated set of recommendations that have been modeled and are ready for a pilot implementation in a six-month period.

- Implementing this new approach will be challenging and should be limited initially to a small number of critical domains. These domains can be prioritized by leveraging research that identifies those occupations and tasks that are most subject to technological disruption (see research cited above).
    - These critical domains clearly include substantial areas of white-collar work.

(See Appendix A for a worked example in the autonomous vehicle field.)

Specific policy tools will naturally be developed at the national level, but as the technology and the dominant private participants are global, it makes sense for the G-20 to create rapid information sharing mechanisms by industry segment. These policy tools will best come from public-private groups focused on specific industry changes at the national level and with the ability to rapidly approve policy frameworks for pilots.

(See Appendix B for a set of policy tools that are likely to be broadly relevant.)

[9] http://agilemanifesto.org/principles.html

Appendix A: Worked example of the impact of autonomous vehicles

There has been wide coverage of how ride-sharing services such as Uber have expanded rapidly as their technology platforms enable millions of "amateur" drivers to replace licensed taxi drivers creating new "gig economy" jobs and downward pressure on wages and benefits of professional drivers. Barriers to entry such as the cost of a taxi medallion and the "knowledge" that a London taxi driver must acquire are replaced with the download of an Uber app, which in turn relies on the GPS, and map-enabled smart phones. Given these pervasive platforms, the marginal cost of the technology to replace one taxi driver is tiny: just one download.

More fundamentally, we see evidence that autonomous vehicles may be able to eliminate professional drivers and truckers altogether. Dismissed as impossible as recently as 2004,[10] advances in machine learning and sensors have enabled Google, Uber, and others to test autonomous vehicles on public roads safely covering over a million miles, and Uber and Otto are now piloting commercial use for taxi and delivery services respectively in Pittsburgh and Ohio.

This dramatic acceleration in innovation is because of semiconductor advances captured by Moore's law and the near zero cost of distributing capabilities through software. As Moore's law has driven down the cost of computing, deep learning software can accurately perceive the environment around it through RADAR and LIDAR sensors, which have collapsed in price from tens of thousands of dollars per car to a few hundred dollars as they shrunk to single chip implementations.[11]

The impact on society is broad and substantial including:

- Safety of transportation by road. (Proponents predict greatly reduced accidents.)
- Radical reductions of the jobs of millions of currently employed professional drivers.
- Reduced benefits for drivers who become part of the "gig economy" working for firms like Uber.
- Issues of liability by the various providers including vehicle manufacturers and service providers such as mapping services and ride sharing services.
- Impact on income inequality as large global technology companies capture most of the benefits of productivity gains and reduced wage costs.

A public-private partnership team for autonomous trucking would include vehicle manufacturers, trucking businesses, labor unions, state, and federal licensing authorities and regulatory agencies covering safety, insurance, labor, and driver licensing.

Specific policies to be modeled and then trialed include:

- To require a driver/loader for each truck but allow certain distance highway driving on complete "auto-pilot" thus capturing some but not all of the productivity benefits.
- Relaxing the current constraints on driver hours to recognize that they can sleep for approved highway sections while the truck proceeds autonomously.
- A set of legal, liability and regulatory changes that support this.
- An investment in retraining displaced drivers including a living wage for a transition period of up to 12 months

[10] "Why People Matter" Levy & Murnane.
[11] Economist - 12/24/16 http://www.economist.com/news/science-and-technology/21712103-new-chips-will-cut-cost-laser-scanning-breakthrough-miniaturising.

Appendix B: Representative set of policy tools for consideration

- A faster cycle time for economic research and labor market data: Government surveys every 5 years are inadequate; a much faster pulse in affected industries will be required with input from employers and unions. Investment is required for research into:
  - Which jobs are being automated and under which economic circumstances?
  - Which jobs can be elevated in skill (and wages) through software assistants?
  - The consequent changes in employment patterns.
  - The skills required for new jobs and re-training approaches that work.
  - Economic and other factors that block workers from retraining.

- Educate government and industry decision makers on the new AI automation capabilities and their potential impact on employment and the opportunity for jobs to be upgraded to more valuable and challenging work. Examples of opportunities to upgrade jobs include:
  - Financial services compliance such as onboarding new customers where AI can currently automate 80-90 percent of the document reviews and flag 10 percent of possible exceptions for human review and resolution. The remaining 10 percent require deeper knowledge, broader experience, and greater cross-functional collaboration and so may well be candidates for on shoring.
  - In IT operations, more than 90 percent of trouble tickets can be resolved by AI software with the remaining tickets being resolved by systems administrators operating at higher levels of expertise.
  - In customer service situations, robotic software can assist the worker in resolving a customer's issue and in parallel suggest a cross-selling opportunity, thus increasing both customer satisfaction and revenue.

- Incentivize worker training for displaced workers: This critical element is the subject of a separate proposal to accelerate social mobility by incentivizing greater private investment in the skill development of 21st century workers ("Training Tax Credit Proposal").

- Wage "top up" support during the transition period to a new role to enable mid-career workers to continue to meet their financial obligations to their families through a training period that could take a year.
  - The objective is to avoid cash flow issues driving workers to lower wage jobs by providing "top up" wages during a transition period of a year or less where they undergo employer-sponsored training supported through the tax credits in the Training Tax Credit Proposal.
  - This temporary assistance can build on the concepts of the guaranteed minimum income that has included adherents such as Milton Friedman[12] and programs such the Progressive Wage in Singapore,[13] which specifically targets higher wages via skills upgrading. Other foundational systems in the G-20 include: the French Revenue de Solidarité Active (RSA),[14] the German Socialhilfe, and the U.K. Tax Credit System.
  - In a few countries there is considerable debate on the national adoption of a living wage but referenda have failed and broad acceptance is not likely in the near term. Targeted use of "wage top up" programs to address dislocation should not wait.

- Working Hours: Speculation on how automation will drive down working hours and increase time for leisure and unpaid voluntary work goes back at least to Keynes but attempts to address unemployment through caps on weekly working hours have at best a mixed record.[15] There is however a long run trend among OECD economies for a slow reduction in hours. Despite this history it is worth examining topics such as:

[12] https://en.wikipedia.org/wiki/Guaranteed_minimum_income.
[13] https://en.wikipedia.org/wiki/Progressive_wage.
http://www.straitstimes.com/singapore/budget-2013-singapores-approach-is-more-than-a-minimum-wage-model.
[14] https://en.wikipedia.org/wiki/Revenu_de_solidarité_active.
[15] "The 35 Hour Week" Marcello Estevão and Filipa Sá ,MIT Economics, Economic Policy July 2008

    - How current overtime, tax, benefits, and regulatory structures drive employers to employ fewer people with longer hours. There is a public policy benefit to changing these structures to share available work.
    - The impact of weakening overtime regulations in the U.S. as more workers fall into exempt categories (administrative, professional, etc.) and the dramatic reduction through inflation of the salary cap to $24,000. There is a pending attempt to reset this to $48,000.

- Catalog critical regulatory elements and policy trials and share them across the G-20. Regulations will need to be modified and clarified to support the benefits of automation. There should be sharing of scenario modeling, pilot results, best practices, and minimum standards in areas such as privacy, workplace regulation, public safety, tax, and accounting to help governments reduce potential:
    - Regulatory arbitrage by global companies.
    - Unintended negative social (and business) consequences.
    - Dampening effects of regulatory uncertainty on private companies.

- Invest in lifetime learning programs that can be accessed by workers throughout their careers and minimize skills shortages to companies due to a mismatch of worker supply and demand (see the Training Tax Credit Proposal). A public-private collaboration to define and plan skills for different sectors is required. *The Economist* January 2017 special report on lifetime learning mentions some examples:
    - Singapore's Skills Future initiative includes industry skills planning over a 3-5 year horizon, with a system of small vouchers for all citizens and 90 percent funding for training for people over 40 years of age.
    - Denmark's Flexisecurity system, a public-private tripartite system for skills planning with paid leave for training as part of collective bargaining agreements.
    - Technology can help with online training through massive online open courses. MOOC systems like Coursera and Udacity offer the prospect of lower costs for students (though they are currently largely accessed by college-educated students[16] and often only for computer science).
    - Generation is a rare example of educational innovation aimed at entry-level jobs and claims 90 percent employment rates for more than 10,000 graduates.[17] It is currently supported by charity but aims to migrate to funding from employers.
    - Corporate investments in training are declining in the U.S. and U.K. but AT&T is an example of a company that is retraining its workers for the digital age with both generous support via tuition fees and an expectation that employees take responsibility for their own training that is assessed in the performance appraisal system. United Technologies also provides up to $12,000 a year in tuition refunds with no strings attached.

[16] "Lifelong Education" - Economist Special Report, January 2017.
[17] https://www.generationinitiative.org/about/ a McKinsey Social Initiative