"Harnessing the Power of Economics to Solve Whole-of-Nation Challenges"

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POSTER ABSTRACTS

Optimizing the Portfolio Withdrawal Rate in Retirement

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William Bengen is credited with devising the "Four Percent Rule" to guide retirees as they draw down their financial portfolios in retirement. This "Four Percent Rule" -- although Bengen never called it that -- has gained wide popularity and has helped boost public awareness about planning for retirement. However, the annual Treasury bond yield data on which Bengen relied may be of questionable suitability for purposes of retirement portfolio analysis. The Treasury bond yield data may not be suitable because those yields are for newly purchased bonds, and retirees are not purchasing bonds but are instead drawing down from their portfolios of bonds in retirement. For retirees, rising bond yields can even be an unwelcome development, as the market value of a bond portfolio moves in the opposite direction of bond yields. I revisit Bengen's results with a different set of annual bond return data from an index that tracks the market value of a portfolio of U.S. bonds: the Bloomberg U.S. Aggregate Bond Index. With this bond index data, I obtain a set of results that largely reinforces Bengen's results with respect to a "SAFEMAX" initial withdrawal rate in the vicinity of 4.5%. I also show that the addition of some more equity diversification to the stock portfolio by including U.S. mid-cap stocks can improve portfolio performance and boost the "SAFEMAX" rate.

Long-Term Impact of Audits on Non-filing Taxpayers

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Non-filers contribute 9 percent, or $32 billion, towards the individual income tax gap. Audits of this population have decreased due to declining resources. Fewer audits not only result in loss of direct revenue, but there are impacts on voluntary compliance, as well. In this paper, we estimate the effect of in-person audits of non-filers on their future filing behavior. We compare the filing behavior of taxpayers audited during Tax Years 2009-2014 against a group of unaudited taxpayers who were eligible for the audit. We find that audited taxpayers are 5.3 to 13.8 percentage points more likely to file a return in subsequent years, an indirect effect that attenuates over time. These findings are qualitatively similar to other studies of the indirect effects of audits on future compliance.

How AI is changing the Markets and reinventing the Economics

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Economics and economic research are revolutionized in the age of Big Data and Artificial Intelligence. Being heavily influenced by engineering and mathematics through various modeling, simulation techniques and experimental methodologies, modern economics, its methods of teaching and research should be revisited and reinvented, adjusted to new reality. As Gregory Mankiw once observed "God put macroeconomics on earth not to propose and test elegant theories but to solve practical problems".

AI and Advanced Machine Learning are based on an enormous volume of Big Data, which is becoming the most important source of increasing total factor productivity, economic growth and development on macro- and micro-levels. These trends are generated by technological forces: exponential growth in the speed of computers, explosive growth of the available data (new Moor's Law), and cloud computing. All of these are altering the competition and the markets, decision making, consumers' and producers' behavior, individual liberties, and freedom to choose. So, we are facing the Hamletian dilemma: is AI the gate to a better future for all or not at all the future, an existential threat to civilization?

From these prospects it is important to focus on a few critical issues for economy and economics: a) what is the economic identity of the Artificial Intelligence, specifically generative AI, from the historical perspective; b) how the challenges, opportunities, and limits of the AI, could be characterized in the Schumpeter's apparently paradoxical terms of "creative destruction"? c) for whom the AI is "working": is it a substitute or complement of capital; what is the AI impact on labor market, particularly, how it is affecting the demand for labor, wages and employment; which effect is prevailing: "displacement" or "productivity" in words of Acemoglu? d) the impact of AI on economic growth and development through intelligent decision-making, transforming social governance, labor and capital, industry 4.0 and innovation, will they have the same impact on transforming the markets as microchips and Internet?

Last, but not least: Economics of Artificial Intelligence is emerging as a new, complex and interdisciplinary rewriting of the classical economics, as its contemporary complement and not a substitute in both branches: Microeconomics – how the AI is modifying the market structures, competition, production and cost, consumers' and producers' behavior; Macroeconomics- how the AI is redefining the Growth and Development, Economic Efficiency, Fiscal and Monetary Policy, Banking, Finance and Business, Government and Regulation. It is important to capitalize on benefits and advantages of the AI for transforming economy and economics as a discipline, for enhancing productivity, efficiency of using the potential of data-rich markets and improving living standards. But it is also important do not overstate the role of AI, to see its limitations, challenges and negative effects reflected, particularly, in increased inequality, "digital protectionism" and "digital authoritarianism". It is necessary to have a balanced approach, to avoid a falls dichotomy between disastrous and totally benign effects of AI.

Biotechnology and Economic Security through the Lens of the Bioindustrial Base: A COVID-19 and mRNA vaccines Case Study

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The COVID-19 pandemic, a threat both predictable and predicted, led to an estimated economic toll in the U.S. of $14 trillion. It sent shock waves through the world economy and triggered the largest global economic crisis in more than a century and an economic shock three times worse than the 2008 financial crisis. Rapid access to vaccines (and vaccination) to provide protection against severe illness from the SARS-CoV-2 represented a singular capability that enabled the return to economic and societal activities--work, school, social gatherings. MITRE has applied an industrial policy framework, heading cautionary lessons from the semiconductor industry, to examine US biodefense capabilities to rapidly manufacturing vaccines against biological threats, with an initial focus on the mRNA platform. This Biotechnology/Biodefense Industrial Base, and US competitiveness is vital to national, economic and health security. A lack of a sustainable biopharma industrial base, including critical infrastructure and a trained workforce, to ensure adequate supply of medical countermeasures, essential medicines, and medical supplies at sufficient scale and speed, warrants urgent action. In consultation with world-class leaders in government, industry and academia, we propose a "10-Point Action Plan for Sustaining a Biopharma/Biotechnology Industrial Base for a More Secure Nation" that includes elements of Policy, Program Management and Execution, Financing and Industrial Base Engagement. It is designed to mitigate risks from these high-consequence events, while fostering a stronger bioeconomy and a safer world.

The Global Commercial Market for Small Satellite Orbital Launch Services

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In the last two decades, technology has allowed governments, research institutions, and corporations to launch a new class of small satellites ("smallsats"), which can provide communications and remote sensing capabilities with lower cost and risk than traditional large satellites. These spacecraft can be launched alongside other payloads on medium and heavy lift vehicles, or choose a smaller rocket dedicated to smallsat launches. The latter can offer greater flexibility in scheduling and destination orbit, but they are more expensive than the "rideshare" option. Given that 48 new small launch vehicles are currently in development, it is worth asking how many satellite operators will choose to make use of them as they become available.

To do this, we looked at a sample of satellites under 600kg launched between 2018 and 2021Q2. We hypothesized that each satellite operator chooses a vehicle based on its cost (pro-rated by mass), perceived reliability, frequency and timeliness of launches, and whether the launch provider is in the same country as the operator. We then estimated a conditional logit (CLGT) model to determine the probability that each vehicle will be chosen, based on the characteristics of both the vehicle and the launch provider.

We found that commercial customers prefer rockets which have a proven safety record, many possible launch windows, and limited delays, showing promise for the new class of flexible and responsive small rockets. The effect of a vehicle's price was found to be inelastic, implying that launch providers have little

incentive to cut prices below current levels. Commercial satellites prefer to hire rockets from the same country, suggesting that US leadership in small rockets is closely tied to US leadership in the fledgling small satellite industry. We found that significant launch delays for US launch providers could significantly hurt US market shares. Finally, we estimated sales for several small rockets currently in development. We anticipate modest demand for each proposed vehicle. While we cannot speak to the forecasted profitability of the new small rockets, a high launch frequency and proven reliability record are unlikely unless the overall demand for smallsat launches increases significantly.

Communication of Uncertainty in AI Regulations

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Scholarship of uncertainty in artificial intelligence (AI) regulation has focused on theories, strategies, and practices to mitigate uncertainty. However, there is little understanding of how federal agencies communicate scientific uncertainties to all stakeholders including the public and regulated industries. This is important for three reasons: one, it highlights what aspects of the issue are quantifiable; two, it displays how agencies explain uncertainties about the issues that are not easily quantified; and three, it shows how knowledgeable agencies perceive the public audience in relation to the issue at hand and what they expect from such communication. This article analyzes notice and rule texts published by rulemaking agencies to understand the following two questions:

1. How do agencies communicate different types of uncertainties in the application of AI?
2. How do agencies' communication goals vary by different types of uncertainty?

The article presents a framework integrating four types of uncertainties (probabilistic, model, deep, moral) and two communication dimensions (mode, goal) emphasized by regulatory bodies, scholars, and practitioners. The article creates a unique dataset by using a text scraping algorithm to match uncertainty-related words from the Loughran-McDonald Master Dictionary (LM Dictionary), maintained by the University of Notre Dame, with regulatory texts from the federal regulations website (regulations.gov) focused on AI regulations. This dataset encompasses excerpts illustrating bureaucratic communication of uncertainty during the rulemaking period from 2018 to 2022, involving 12 rules and 10 notices. The dataset is subsequently analyzed, coding for various types of uncertainty, communication methods (numeric and text formats), and the intended goal of communicating uncertainty.

Quantitative analyses using descriptive statistics across four categories of scientific uncertainties shows that over 60% of uncertainty is expressed through textual representation such as citing examples and defining the uncertainty and is heavily driven by moral and model uncertainty. In addition, a majority (54%) of excerpts with uncertainty came from notices rather than rules. While this could be attributed to sampling bias, it could also signal that agencies disclose uncertainty in early rulemaking stage than later to preempt challenges from the court or public comments as evidenced by previous studies.

Further qualitative analysis of specific excerpts demonstrates that uncertainties related to ownership, safety, and transparency prove challenging to quantify. As a result, regulatory agencies resort to employing personalized examples to elucidate these uncertainties. Additionally, excerpts featuring moral uncertainties, like assigning a driver in an automated driver system, are often succeeded by the articulation of broader problems and a desire to seek public consensus. Conversely, instances involving

probabilistic uncertainty prompt agencies to follow up with precise inquiries regarding data sources and methods. These findings align with existing literature on addressing uncertainty and informing regulatory decision-making. They offer valuable insights to enhance our comprehension of current practices in effectively communicating science to elucidate risks and uncertainties.

High and Dry: A Water Security Story

Mark Phillips and Jillian Humphreys, The MITRE Corporation

A poster series explores a future of water security and scarcity in the face of a rapidly warming world. The story begins with an inciting incident as the Colorado river reaches 'deadpool' status. No fresh water can be drawn from the river, leaving the fictional town of Silverbrush facing a zero-day water event and the implications and consequences such an event presents. Water scarcity is defined two ways- physical access and economic access. Through story and immersion, the implications of both definitions are explored. Speculative design methods and Foresight, coupled with data from SSP models resulted in this novel depiction.

A Decision-Making Tool for Optimizing Air Ambulance Locations

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Air ambulances can provide more rapid access to medical care than ground ambulances for rural, underserved, and hard-to-reach populations. Prior demand assessments of this critical healthcare transportation service have failed to undertake a systems-level approach to health planning for all populations. This prevents planners from prioritizing the delivery of this health service based on population health needs. To identify coverage gaps in the U.S. ambulance system, we analyze detailed event-level emergency medical services (EMS) data from the National Emergency Medical Services Information System (NEMSIS), which includes the clinical conditions of patients using air ambulances. We combine this data with ZIP-code-level data on chronic disease risk factors from the Centers for Disease Control and Prevention (CDC) to identify the number of potential candidates in each ZIP-code that are at higher risk of experiencing health conditions associated with air ambulance transports. Our methodology emphasizes the delivery of air ambulance services based on population need. We first applied this method to data from the state of Virginia and the New England region to model air ambulance demand for patients at risk of heart attacks and strokes. We identified a total of 587,000 and 1,040,000 individuals, respectively, who are at risk each year of requiring an air ambulance transport. Our approach also has planning and policy implications for locating air ambulance bases where the greatest health needs are, improving the delivery of this crucial service, and addressing historic inequities for critical care and trauma medicine.

Postal Reform Project: Helping Treasury Advocate for Better Policy

Joe Kennedy, The MITRE Corporation

The United States Parcel Service is as old as the country. Despite rapid population growth and significant changes in technology, it remains one of the most trusted institutions in America. Unfortunately, the Service currently faces significant challenges to its future viability. Large companies, including UPS, FedEx, and Amazon are competing heavily for the growing package-delivery segment. Email and the Internet are rapidly diminishing the volume of regular mail. The number of households increases every year, as does the cost of employee retirements.

In April, 2018, President Trump issued an Executive Order calling on the Department of the Treasury to issue a comprehensive report on the financial status of the Postal Service and plans for reform. Treasury quickly turned to MITRE to lead the project. Working closely with key policy officials, MITRE assembled a team of roughly a dozen MITRE employees and five subject matter experts to study the issues and deliver a report to the Secretary. This report essentially became the first draft of the study called for in the Executive Order.

The MITRE team started with a review of the Postal Service's history and its current ideas for reform. It also conducted a thorough review of business trends and the Service's finances. The study eventually concluded that the Service's long-term liabilities exceeded $180 billion and that its long-term assets (largely buildings) would be difficult to liquidate. This imbalance is unlikely to reverse itself since the Service currently experiences significant operating losses each year. Although several reforms have been proposed, MITRE found that many would have only a marginal impact on finances. Others merely shifted liabilities from the Postal Service to the federal government, essentially putting the cost on taxpayers rather than postal users.

MITRE's report also looked at reforms that could make a noticeable difference, including a reexamination of the size and coverage of current postal subsidies. Within four months of beginning this project, MITRE turned over a rough draft and detailed economic analysis to the Department of the Treasury, allowing it to quickly add changes that made the final report its own and present it to the President. Earlier this year Congress enacted bipartisan reform that addressed many of the issues raised by this project.

Use of a Risk Scoring Model to Assess and Prioritize Areas of Fraud, Waste, and Abuse in Medicare Home Health

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Opportunities for fraud, waste and abuse occur in virtually all healthcare programs. These opportunities, described as vulnerabilities, can be 1) identified/evaluated 2) scored, and 3) mitigated. We describe the second step, risk scoring, which determines the scope and impact of vulnerabilities. It may also inform the sponsor (Medicare Center for Program Integrity) on prioritization of mitigations (third step above). We describe the process for risk scoring in one Medicare healthcare program, Home Health as a use case.

Before scoring, environmental scanning and research was conducted to identify, evaluate, and describe vulnerabilities in Medicare Home Health and in the context of relevant policy. Risk scoring was then

completed to score each vulnerability based on three components: 1) Dollars at Risk (DaR), 2) Likelihood, and 3) Beneficiary Harm. Dollars at Risk was defined as the total Medicare dollars that could be at risk of improper payment due to the presence of the vulnerability. Based on the calculated DaR, a different score was assigned: 1: <$10,000; 2: $10,000-$100,000,000; 3: $100,000,000-$200,000,000; 4: >$200,000,000. Likelihood was defined as the extent to which the vulnerability exists in Medicare Home Health, estimated as a percentage. The likelihood (%) multiplied by the DaR yielded an improper payment amount, which was a portion of the DaR that represents the amount ($) of Medicare funds that was inappropriately paid to Medicare Home Health. Based on the calculated likelihood, a different score was assigned: 1: <25%: Unlikely; 2: 25-50%: Possible; 3: 50-75%: Likely; 4: >75%: Almost Certain. Finally, beneficiary harm was defined as the impact to an individual beneficiary based on the degree of physical harm, financial harm, and/or identity theft and was scored as follows: 1: No Harm; 2: Minimal Harm; 3: Significant Harm; 4: Life-Threatening. Scores for each DaR, Likelihood and Beneficiary Harm were summed to provide a risk score for each vulnerability.

Sixteen vulnerabilities were identified and scored in Medicare Home Health including opioids (score: 9), identify theft (score: 8), beneficiary inducement (score: 7), beneficiary recycling (score: 7), false certification (score: 7), false documentation (score: 7), homebound (score: 7), kickbacks (score: 7), Low Utilization Payment Adjustment (LUPA) (score: 7), The Outcomes and Assessment Information Set (OASIS) accuracy (score: 7), Patient-Driven Grouping Model (PDGM): Beneficiary Status Manipulation (score: 7), Skilled Services (score: 7), Dual-Eligibles (score: 6), Nominee Owners (score: 6), Self-referral (score: 6) and Home Infusion Therapy (score: 5). The Dollars at Risk ranged from $398,000,000 to $17,800,000,000 and the likelihood ranged from 0.2% to 32% per vulnerability. Beneficiary Harm ranged from 1 (No Harm) to 4 (Significant Harm).

The process of risk scoring provides the sponsor the ability to effectively allocate limited resources on the mitigation of vulnerabilities, the third step described in the background section. Resource allocation is an important goal of health economics and more broadly, microeconomic evaluations. Thus, this risk scoring methodology can be applied to other fraud, waste, and abuse evaluations and risk assessments more broadly outside of healthcare.

Quantifying Equity: From Principles to Metrics

Josh Stadlan, Saimun Habib

Government agencies are mandated with social equity assessments and determining whether policy impacts are aligned with their social justice and equity principles. However, there is a lack of clarity and guidance on conducting quantitative equity assessments and on how existing metrics may correspond to the principles of an agency. This effort focuses upon filling this gap and MITRE is well situated to do so because of it's relationships with whole of government. The goal is to understand different inequality metrics in domains ranging from wealth economics, healthcare, segregation, algorithmic fairness, and lift them out of their domain specific applications to compare, contrast, and characterize how they approach inequality. By understanding what these different metrics measure, their theoretical properties, and how they fit into different paradigms of social justice and equity, agencies and communities can leverage sound and intentional quantitative approaches to bolster their equity vision.