DAY 1 | Monday, March 16
8:00 am – 9:00 am  Registration and Breakfast

9:00 am – 10:30 am Session 1
1.A Surviving Judicial Review
Chair: Jennifer Baxter, Industrial Economics, Inc.
Discussant: Jonathan Wiener, Duke University School of Law

Presentations:

- An Empirical Analysis of Legal Challenges to Regulatory Policymaking Under Trump; Bethany Davis Noll, NYU School of Law - Institute for Policy Integrity
  - Presidents have increasingly turned to administrative agencies to make substantive regulatory policy. But agency decisions are subject to judicial review and success in those legal challenges is a key determinant of the pace—and content—of policymaking by the federal government. Traditionally, agencies have prevailed in most legal challenges to their actions but during the Trump administration, agencies have lost about 90% of the time. The question is what is driving these results. There are many potential hypotheses that might explain this loss rate. This project aims to shed light that question through an empirical analysis of litigation outcomes in legal challenges to agency actions during the Trump administration. I tentatively reach three findings. First, courts have been most likely to reverse or vacate agency actions because the agency acted in excess of its statutory authority or in violation of statutory requirements. Second, the losses have continued even as agencies took more time to issue rules and avoided the early mistakes, suggesting that the losses are not primarily attributable to early rushed decisionmaking. Finally, I find that the party of the President who appointed the reviewing judge does not predict the likelihood that a legal challenge to an agency action will succeed. These findings cast doubt on claims that Congress has given agencies a blank check to make policy consistent with the preferences of the incumbent administration. In the Trump era, procedural requirements and statutory requirements have significantly limited agencies’ freedom to implement the president’s political and ideological program.

- Trump, Deregulation, the Courts, and Benefit-Cost Analysis; John Graham, Indiana University
  - This paper will examine what has been accomplished by the Trump administration in the field of deregulation. OMB data will be employed to show how many deregulatory actions have been initiated and completed in comparison to the Reagan administration. NYU data will be utilized to show how Trump’s deregulatory actions are faring in the federal courts. A case will be made that the Trump administration’s high rate of loss in
judicial decisions about deregulation is attributable to inadequate analysis of the benefits and costs of deregulatory actions. Recommendations are made as to how the administration can do a better job of benefit-cost analysis of deregulation.

- Economic Analysis and Litigation Risk; Jerry Ellig, GWU Regulatory Studies Center
  - Legal scholars predict that courts will pay closer attention to regulatory agencies’ economic analysis as a result of the Michigan vs. EPA case, which held that it is arbitrary and capricious for an agency to ignore regulatory costs in the absence of a statutory prohibition on doing so. This presentation summarizes some empirical data on the quality of regulatory agencies’ economic analysis and litigation risk. Key findings include: (1) Courts have examined the economic analysis accompanying a nontrivial number of regulations; (2) Courts have vacated or remanded a nontrivial subset of these regulations due to insufficient economic analysis; (3) Interviews with senior agency economists and attorneys who work on regulations reveal that they believe higher-quality economic analysis reduces the likelihood that a regulation will be overturned in court; (4) Regulatory agencies tend to produce more thorough economic analysis for a regulation when a court has previously examined the agency’s economic analysis for a regulation issued under the same or a predecessor statute; and (5) Regulatory agencies tend to produce more thorough economic analysis when the authorizing statute is more specific about the economic considerations the agency must examine.

1.B Electric/Energetic Benefit-Cost Analysis
Chair/Discussant: Nancy Bergeron, Measurement Canada & CBA Community of Practice of the Community of Federal Regulators
Presentations:
- Electricity Shortages and Costs of Self-generation; Majid Hashemi, Clemson University
  - This study utilizes a rich dataset from Nepal to explore the economic decision making of firms when making investments in electricity generation equipment and in their operation with the purpose of mitigating the unreliable nature of the supply of electricity from the public grid. Despite the fact that self-generation reduces the negative welfare impact of electricity shortages to some extent, this paper attempts to show that self-generation of electricity is an imperfect substitute to an improved on-grid electricity service. The findings show that firms engaging in self-generation are willing to pay a premium additional to their current electricity bills for the supply of power which would prevent an outage. The findings of the willingness to pay analysis are validated by the actual behavior of firms when it comes to the intensive and extensive margins of self-generation. While firms with more reliance on electricity as an input of production are more likely to invest in self-generation equipment, they run their equipment for relatively shorter duration when the public grid is down. Given that chronic electricity shortages are one of the major impediments to firm growth in developing countries, the findings of this study provide guidance to electric utilities and planners of the economic value of improving electricity service reliability.
• **Efficient Provisioning for Cost Overruns in Hydro Electric Dam Construction; Glenn Jenkins, Queen's University and Eastern Mediterranean University, Saule Baurzhan, Eastern Mediterranean University**

  - A growing literature exists that has documented the extent and alleged motivations for cost overruns in large hydro electric dam construction. The recommendation that has arisen from this literature is that provisioning for cost overruns should be based on reference based forecasting. In this way the experience with cost overruns in dam construction in the past should be used to forecast the likely cost overruns to be experienced in the construction of a type of dam under consideration in a location in the world. It is postulated that there is a systematic optimism bias that produces ex ante estimates of construction costs that are on average below ex poste costs. This work has largely ignored the benefits arising from future operation of the hydro-electric dams. This study considers 57 hydro electricity generation dams from around the world that were financed by the World Bank from 1975 to 2015. The ex-ante estimates of construction costs and the net present values of each dam are known. An ex-poste appraisal is also done for each dam with estimates made of real and nominal cost overruns, time overruns and the net present value realized from each dam. Although about 30 percent of dams had cost overruns, one can not conclude that a systematic bias has existed in the ex-ante estimation of costs. Any attempt to apply a uniform uplift to the ex-ante estimates of costs (as low as 5 % of ex-ante costs) ends up reducing the overall NPV of the portfolio of projects. It would have prevented dams from being selected for funding that from the ex-poste analysis have generated larger positive NPVs for society than the general uplifts would have prevented dams being selected that ex-poste have negative NPVs. In the case of the portfolio of hydro dam projects financed by the World Bank, a reference class forecasting system to account for possible cost overruns could lead to economic inefficiencies of more than 100 billion dollars.

• **Estimating Consumer Willingness to Pay for Solar PV Under Uncertainty; Martin Heintzelman, Clarkson University**

  - Rooftop solar PV systems have significant potential to help society move towards a renewable energy future. A number of incentive systems have been in place in different areas to encourage residential adoption of solar PV technology with varying levels of success. This paper looks to understand consumer WTP for solar PV technology under uncertainty about payback periods. We use a stated preference choice experiment approach to estimate this WTP at the household level. Specifically, we vary project cost, monthly savings, and the range of uncertainty about monthly savings. This allows us to estimate WTP for solar installations as a function of both the payback period (upfront cost divided by monthly savings) and the amount of uncertainty about the payback period. In addition to this choice data, we collect a wide range of demographic and social/psychological data using existing psychological scales designed to measure motivation towards the environment, general attitudes towards the environment, and other personality and attitudinal attributes. These are used to help understand the personal factors that help drive environmental behaviors and, specifically, adoption of
rooftop solar PV installations. Our sample of more than 500 individual householders spans a range of income and educational levels which allows us to specifically focus on what policy measures might help spur adoption among lower income categories. Preliminary analysis is ongoing, but all survey data has been collected. Preliminary results are not yet available.

- Regulating the Energy Transition: FERC and Cost-Benefit Analysis; Avi Zevin, Institute for Policy Integrity at NYU Law
  - The energy system is in the midst of a transition. Technological advances and growing public concern about global climate change are leading to a substantial increase in production and use of new energy resources, including natural gas, wind turbines, solar photovoltaics, battery storage, and demand response. The success of this transition will depend on the considered deployment of energy infrastructure and reform of the rules that govern the operation of the electric system. One federal agency—the Federal Energy Regulatory Commission (FERC)—is responsible both for approving key energy infrastructure projects and for overseeing the operation of electric markets, and so will play a critical role in guiding the transformation of the energy system while maintaining its reliability and affordability. This Article argues that, FERC's management of this transition would be significantly enhanced if it embraced cost-benefit analysis to guide its decisionmaking. While many other federal agencies have adopted the use of cost-benefit analysis, FERC has been a significant laggard. This Article explains that changing course and adopting cost-benefit analysis will allow FERC to maximize social welfare, enhance transparency and accountability, and mitigate legal and political risk. The Article does so by focusing on two of FERC's most significant responsibilities—approval of electric market rules and of natural gas infrastructure certificates. For each, the Article evaluates FERC's current approach to decisionmaking, concludes that FERC has the statutory authority to use cost-benefit analysis, and identifies relevant costs and benefits that FERC can consider and the economic tools available to do so.

1.C Roadways to Better Highway and Infrastructure Investments
Chair: Deborah Aiken, U.S. Department of Transportation
Discussant: Jack Wells, Director, Office of Economic and Strategic Analysis (retired)
Presentations:
- Measuring the Impact of Gender Empowerment from Rural Road Improvement Program in Morocco; Takeshi Daimon, Waseda University
  - This paper provides an evaluation of Rural Road Improvement Program in Morocco, which was intended to improve local road networks, assisted by international donors (of which World Bank, European Union and Japan International Cooperation Agency (or JICA) were the largest financial contributors), increasing transportation connectivity for enhancing economic and social activities in the rural areas in the country. The economic benefits exceeded costs, according to the evaluation studies conducted by the World Bank and JICA. The question remains as to how the benefits have been distributed between men and women, especially in rural areas where traditional social norms in...
favor of dominance of male are still dominant though modern laws (constitution, labor law, etc) prohibit gender-based discrimination on getting a job, getting paid, and getting promoted. This paper addresses this question: how and to what extent has the improvement of rural roads in Morocco has contributed to the gender gap in schooling and work conditions? The paper uses micro-data collected from 2,000 households in target and non-target areas, asking the household in treatment and control group about their social conditions (years of schooling, cost of schooling, access to medical facilities, and quality of medical facilities) in the post-project time period of 2011. The data have been collected by a Moroccan think tank, with financing from JICA, and have become available quite recently for researchers. During the field visit to rural areas in treatment group, the author conducted "focused-group discussion" with community female residents encouraging them to express themselves through group discussion. In this way, this paper provides both quantitative and qualitative analytical methods to measure gender-empowerment impacts and compare them with the costs of the project. The author conducted cost-benefit analysis of the program, which confirmed the results of the previous cost-benefit analysis. The logit analysis regarding the choice of attending a school or not for individual has proven to be significantly positively correlated with the road improvement but is not gender sensitive. The years of schooling are also positively correlated with the road improvement and is negatively correlated with the dummy variable of female individuals, consistent with our intuition. The focused-group discussion with local female residents recognized the importance of improved roads and recognize general contribution to their social life (access to the farms, markets, clinics, etc.). Overall, the improvement of road road in Morocco has brought about positive economic results for rural households and individuals, inclusive of women.

- Using HDM-4 to Reduce Costs or Improve Precision of Road Cost-Benefit Analyses; Jack Molyneaux, Millenium Challenge Corporation, Cindy Sobeiski, Millenium Challenge Corporation
  - The HDM-4 model presents an unusually practical opportunity to reduce costs (or improve accuracy) of road evaluation cost-benefit analyses (CBAs). The model is used across much of the world by highway engineers and transport economists to calculate the net economic benefits of road improvements, commonly reported as their economic rates of return (ERRs.) It offers software that can easily simulate the effects of alternative pavement and vehicle characteristics on the ERR. Highway engineers most commonly use the model to inform road designs. But it is similarly useful to inform post-investment evaluation CBA planning. This is especially useful at MCC, where the mandate to complete an evaluation CBA of every project imposes a high priority on maintaining a reasonable balance between the costs and expected benefits of the exercise.
  - By simulating HDM-4 model results, MCC’s evaluators have run sensitivity analyses that explicitly compare each data collection activity's contribution to ERR precision with its corresponding costs. This allows MCC's Evaluation Management Committee and the evaluator to use a shared optimizing framework when considering which types and
intensities of data collection activities are warranted. This approach has helped MCC’s evaluators reduce the costs of road data collection practices that are ‘traditionally’ collected to inform road investment designs but turn out are not needed for evaluation-based (after the project) economic analysis. For example, geotechnical measurements are likely needed at the project design stage of a road rehabilitation, to understand the existing pavement. But, at the evaluation-based CBA stage, if as-built drawings are available and trusted, such measurements add little to the precision of the ERR, and their cost may not be justified. In the case of the Mongolia I North-South Road Evaluation, conducting such sensitivity analyses resulted in a cost savings of $200,000 from the originally proposed evaluation design.

• Cost-Benefits Analysis for Brazilian Transport Infrastructure; Cicero Rodrigues De Melo Filho, Empresa De Planejamento E Logistica – EPL, Dornelas Munhoz, Empresa De Planejamento E Logistica – EPL
  o EPL is a State-Owned Enterprise created by Law nº 12743 from December 2012. EPL is under the authority of the Ministry of Infrastructure. EPL is responsible for the development of a National Logistics Plan (PNL) that will allow integration of infrastructure investments, operations, services and the network of roads, railways, ports, airports and waterways, and its prioritization. PNL will identify bottlenecks and investment opportunities in the short, medium and long term, in order to provide seamless and efficient movement of inputs and finished goods across the country. The plan will also propose solutions that tie infrastructure and services to address public needs as well as private goals. Building large infrastructure is a very difficult undertaking. Historically, the development of infrastructure in Brazil has been subject to strong political interference. To separate the purely political issues (that may be legitimate) from economic and technical aspects, EPL developed a Cost-Benefit Analysis (CBA) methodology. The Cost-Benefit Analysis (CBA) is an analytical tool that shall be mandatory for the appraisal of major infrastructural projects to measure the benefits and the costs of the projects to society thereby contributing to Brazilian strategic policy objectives. The purpose of the CBA is to facilitate a more efficient allocation of resources by providing evidence of the advantages of a particular option in respect to other alternatives. EPL’s CBA framework, supported by detailed and objective technical information, will improve investment decisions in relation to decision-making based purely on political interests, poorly defined objectives or wish-lists.
  EPL uses a CBA methodology to support transport infrastructure investments for the first time in Brazil. EPL’s CBA framework considers the social benefits and investment and operational costs accounting for travel time, safety, vehicle operating costs, and carbon emissions’ benefits, among others. All these social benefits can be monetized for road, rail, ports, airports and waterways, as well as for multi-modal projects. EPL prepared an initial case-study using the CBA methodology to compare three competing greenfield projects (road, rail and waterway) for the transport of soybean produce from Midwest to the North of Brazil. The baseline scenario used was a single carriageway road. Finally, EPL also prepared and published a Guide to Cost-Benefit Analysis of
transport investment projects and a related table of coefficients on its website, granting free access to any Brazilian national. The EPL's CBA framework will also be used by the Brazilian Government to rank the projects in the portfolio of the PNL.

- Estimation of The Economic Opportunity Cost of Capital in The East African Community Countries; Abdallah Othman, Glenn Jenkins, Queen's University
  - The economic opportunity cost of capital is a key parameter in cost benefit analysis that is used to improve the resources allocation effects in the country, and thus the impact on society's well-being in the future. The choice of this parameter can make a significant impact on the priorities of public projects by screening out low return projects and allowing the more productivity to proceed for financing. If a project's net benefits have a positive net present value discounted at an appropriate rate, then a project would cover its opportunity cost and generates more wealth for society. The estimation of the (EOCK) is based on the view that 'the 'marginal' source of funds for both the public and private sectors is usually the capital market. When funds are raised in the capital market to finance an investment project, those funds are ultimately come from three diverted sources; displaced investment, newly stimulated domestic savings (displaced consumption) and newly stimulated capital inflows from abroad. To the best of knowledge, this is the first study in the field that estimates the EOCK for East African Community (EAC) economies. Due to the considerable amount of both ongoing and new public investment projects in this region, this study aims to provide policy makers with an appropriate social discount rate used for appraising public investment projects that would practically contribute to the resource allocation effects in the economy. By applying the weighted average approach, the results show a tiny range of 11.79% – 12.94% in EOCK for these countries. Based on the empirical results and sensitivity analysis, we recommend that a conservative estimate of EOCK in Kenya and Uganda to be set at 12%, While it is 13% in Rwanda and Tanzania. The appropriate EOCK estimated in this paper expected to support the cost-benefit analysis for public investment projects in EAC countries and hence improving the resources allocation effect as well as the society's well-being in the future.

1.D Social Program Evaluation
Chair: Lynn Karoly, RAND
Discussant: Sue Hamann, PhD, NIH/NIDCR/OD
Presentations:
- The Job Ladder Model of Education: An Overlapping Generations Treatment; Sibabrata Das, International Monetary Fund
  - This paper develops an overlapping generations model of education that helps to illustrate the issues of wage stickiness in the labor market for educated workers. Restuccia and Vandenbroucke (2011, 2013) have used the overlapping generations framework to study the educational attainment over much of the 20th century in the United States. Jones and Yang (2013) have used this framework to analyze the increasing costs of higher education in developed countries. The main contribution here
is to incorporate the job ladder assumption (Bhagawati-Srinivasan 1973) into the overlapping generations models of education to analyze the impact of wage rigidities on the size of the educated labor force. It analyzes the impact of wage rigidities in a less-restrictive framework where individuals can choose education based on ability and cost. In this formulation, individuals can choose education based on ability and cost. Thus, an advantage of the overlapping generations model with the job ladder assumption is that demand for schooling is endogenous, and so it produces an endogenous teacher-to-student ratio in efficiency units. It is assumed that education decisions are based on labor market returns and the cost of tuition. Our findings show that if the institutionally fixed wage in the formal sector is sufficiently large, and/or the subsistence wage in the traditional sector is sufficiently low (all relative to the flexible equilibrium wage), such that the formal-subistence wage gap in fix-price equilibrium exceeds the wage gap of flexible equilibrium, then the ex-ante expected wage of an educated worker is higher in the job ladder (fix-price) equilibrium. Hence the demand for education is higher in the fix-price scenario than in the flexible market equilibrium. Thus, in addition to some interesting analytical results, using data on the educated labor force employed in skilled and unskilled sectors, average costs of education, some estimates of the discount rate, and estimates of wage differentials between skilled and unskilled workers, we can calibrate this model under various cost-specifications and ability density functions. We would like to show some numerical examples of calibrating this model and do further this calibration in our future research. We can also use this model to analyze the impact of various policy instruments on the size of the educated labor force and minimum threshold levels that we have used in the Bhagawati-Srinivasan job ladder framework.

- Benefit-Cost Analysis of the PMTO-ADAPT Program for Military Families with Deployed Parents; Hayley Rahl-Brigman, University of Minnesota – Twin Cities, Nishank Varshney, University of Minnesota

  - Parent Management Training Oregon Model (PMTO) interventions constitute the largest group of parent training interventions in evidence-based databases. PMTO-ADAPT (After Deployment: Adaptive Parenting Tools) is an innovative version of the PMTO intervention adapted for military families with at least one previously deployed parent. PMTO-ADAPT has been evaluated through both efficacy and effectiveness trials and is currently being implemented in some of the largest military bases. Previous studies of the PMTO-ADAPT program have found significant intervention-related improvements in parent mental health, parenting, and child adjustment; however, there has not yet been a benefit-cost analysis of this program for military families. This study examines the cost of implementing this program and estimates benefits related to reductions in suffering and disease burden. This study uses previously conducted research (Gewirtz, DeGarmo & Zamir, 2016; Gewirtz, DeGarmo & Zamir, 2018) to estimate the effects of this short-term parent training program implemented in the context of a Randomized Controlled Trial conducted in Minnesota. A total of 336 National Guard families were enrolled in the ADAPT study and randomized to either treatment-as-usual or the intervention. The intervention consisted of 14 weeks of weekly 2-hour group classes, daily homework, and
weekly calls with the class instructor. N = 207 families were randomized to the intervention and N = 175 families attended at least one face-to-face group session or completed at least one online module. We estimate the cost of the program through personal interviews of the project staff and using the budget documents. To estimate the program implementation cost per family, total implementation costs were divided by the number of families that finally participated in the program, while the research and development costs were divided among all the families who attended a baseline assessment prior to randomization. We estimate the dollar value of benefits associated with outcomes such as a reduction in parent post-traumatic stress disorder (PTSD), improved parent functioning, and better child adjustment. We calculate the benefits for both - the families participating in the program, and the society at large. Further, we calculate the benefit-cost ratio of the program to assess whether the benefits of the program outweigh its costs. We also check the robustness of our analysis by using a range of the cost and benefit estimates and conduct a sensitivity analysis to account for a varying range of discount rates. Results from this study will address whether the beneficial effects of the PMTO-ADAPT program on the well-being of military families and deployed parents outweigh the costs.

• Effectiveness of Screened, Demand-Driven Job Training Programs for Disadvantaged Workers; Matthew Baird, RAND Corporation
  o We evaluated a job training program for low-income individuals in New Orleans through an RCT. The job training was 2 to 4 months long, in several areas in advanced manufacturing, healthcare, and information technology. We did an implementation analysis, an outcome analysis, and a benefit-cost analysis, all to evaluate the effectiveness of the program in preparing individuals for better employment, with higher earnings. We used both administrative data on earnings and primary data collection of the costs of the program. We found that the program had a significant impact on earnings with about a 25 percent increase in earnings. We further found that it had a positive return on investment, with benefits exceeding costs immediately for participants, in five years for the government, and in three years for society (participants plus the government).

• A Comparison of VA Telehealth and Standard Health Care Services Among Veterans; Tamara Lee, Department of Veterans Affairs, Eddie Thomas, Department of Veterans Affairs, Mark Guagliardo, Department of Veterans Affairs
  o Telehealth is the delivery of health care using information and communication technology and is characterized by the geographical separation of patient and provider. In the Department of Veterans Affairs (VA), telehealth also includes the wider application of care and case management principles to the delivery of health care services using health informatics, disease management and telehealth technologies. VA telehealth is available in a variety of forms and places special emphasis on aging Veterans or those in rural and remote locations. The most common rationales for its introduction have been to decrease costs, improve efficiency and increase access to health care. However, existing research either does not focus on Veterans health or has included a limited number of VA facilities. This analysis includes outpatient telehealth
encounters facilitated by all VA facilities and compares associated costs and travel time
with standard, face-to-face visits. This study includes mental health outpatient
telehealth encounters associated with all VA facilities in 2017. We compare costs of
telehealth visits with comparable face-to-visits. We also estimate the travel time
savings afforded by telehealth visits.

Chair/Discussant: Steven Lize, The Pew Charitable Trusts
Panel:

- Legislatively-Driven Efforts to Advance the Use of Data and Evidence in Budgeting; Jon Courtney,
  New Mexico Legislative Finance Committee
  - Jon Courtney will present on brokering economic evidence to legislators and applying
    BCA in budget planning. The New Mexico Legislative Finance Committee makes
    budgetary recommendations to the Legislature for funding state government, higher
    education and public schools. The Legislative Finance Committee also prepares
    legislation addressing financial and management issues of state government. The
    program evaluation unit reviews the costs, efficiency and effectiveness of activities of
    state agencies and political subdivisions and recommends changes to the legislature.
    The Legislative Finance Committee has used BCA to assess the evidence on
    implementing early childhood education programs to address severe learning
    achievement gaps. Reflecting on that work, the presenter will highlight the process of
determining legislators’ policy goals, negotiating scope of analysis, overcoming data
access and methodological challenges, and communicating findings that were ultimately
utilized in budget choices. The presenter will discuss how the Legislative Finance
Committee presently monitors the implementation of new education program
investments, benchmarked against BCA projections.

- Dynamic Marginal Cost and Bridging the Gap Between CBA Theory and Actual Budgeting
  Practices; Nathaniel Inglis Steinfeld, Illinois Sentencing Policy Advisory Council; Adam Groner,
  Illinois Governor’s Office of Management and Budget
  - Nate Steinfeld and Adam Groner will introduce an innovative method the Illinois
    Sentencing Policy Advisory Committee (SPAC) developed for estimating a dynamic
    marginal cost for Illinois criminal justice agencies. SPAC collects, analyzes and presents
data to more accurately determine the consequences of sentencing policy decisions and
to review the effectiveness and efficiency of current sentencing policies and practices.
    SPAC reports directly to the Governor and the General Assembly. SPAC developed a
    dynamic marginal cost approach for producing realistic estimates of proposed crime
    policies for government budget planning. Since the context matters, the presenters will
discuss the Illinois budget process in state and county governments, infrastructure
challenges with regards to prisons and jails, and the challenges to using marginal costs
with state procurement and employment laws. The presenters will conclude with how
that analysis has influenced policy decisions in Illinois. Chiefly, the Illinois Budgeting for
Results Commission, staffed by the Governor’s Office of Management and Budget,
integrates BCA into a program evaluation and accountability process for legislators and
budget staff. Illinois Budgeting for Results utilizes a method of budgeting where each
priority must be justified each year according to merit rather than according to the
amount appropriated for the preceding year. In 2016, the Budgeting for Results
Commission adopted benefit-cost analysis methods into their program accountability
review. The commission utilizes the cost methods developed by the Illinois Sentencing
Policy Advisory Committee. The committee has used BCA to examine the impact of several treatment and supervision approaches deployed by Illinois criminal justice and juvenile justice agencies.

- Integrating Benefit Cost-Analysis and Evidence Teams in the Executive Budget Office; Carrie Hollis, North Carolina Office of State Budget and Management
  - Carrie Hollis will discuss how the North Carolina Office of State Budget and Management (OSBM) recently reorganized to strengthen its focus on evidence-based budgeting, data driven decisions, and strategic management. The OSBM is tasked with delivering the highest quality statewide budgetary, management, and information services to advise the Governor, state agencies, and the legislature on the most effective use of public resources. The services of the OSBM include budget development, budget certification, and budget execution. Additionally, OSBM offers tools to support decision-making by conducting management studies, strategic planning analyses, fiscal note review for rulemaking, and internal audits. The presenter will discuss two innovations toward building a culture of evidence-based policymaking within the budget office and across state government. In the past year, the OSBM introduced a new initiative to encourage agencies to submit in their budget requests information that demonstrates the effectiveness and value of proposed programs and lines of services, emphasizing the use of rigorous scientific and economic research. The OSBM also began assessing program evidence by policy subject area, incorporating BCA. The presenter will highlight the experiences of a state in the early stages of adopting and applying these tools, highlighting the successes and challenges of incorporating BCA findings into established decision-making processes.

10:30 am – 10:45 am  Break

10:45 am – 12:15 pm  Session 2
Chair: Clark Nardinelli, Past President, Society for Benefit-Cost Analysis
Presenters:
- Susan Dudley, George Washington University Regulatory Studies Center, Former OIRA Administrator
- Dominic Mancini, OIRA
- Howard Shelanski, Georgetown University Law School, Former OIRA Administrator
- Stuart Shapiro, Rutgers University
- Jonathan B. Wiener, Duke University School of Law

2.B Nothing is more Practical than Good Theories/Methods - I
Chair: Dan Acland, University of California, Berkeley, Goldman School of Public Policy
Discussant: Matthew Adler, Duke University School of Law
Presentations
- The Efficiency-Equity Trade-off, Self-Interest, and Moral Principles in Valuation; Danae Arroyos-Calvera, University of Birmingham
  - Policy makers try to take account of public preferences when making trade-offs between policy options. Yet most estimates of the value of health and safety reflect only individuals' self-interested preferences, neglecting their preferences over the
distribution of public resources. To ensure that resource allocations maximise social welfare, policies should ideally reflect the trade-offs that individuals would make between self-interest, efficiency and other distributional concerns. However, we do not yet have an adequate account of these trade-offs in applied contexts. We conducted an experiment (n=322) in which participants had to choose between policy options that differ in their efficiency (expected number of fatalities or cases of ill health they would prevent) and their equity (defined in terms of the balance of risk reductions for different sections of the population). The policy options were framed as interventions to improve a hypothetical city's water supply that would reduce the risk of death or ill health for people in different areas of the city to varying degrees. We manipulated self-interest between subjects by telling half of the participants that they could personally benefit from some of the risk reduction options. The other half were not told that and could therefore take an impartial view, analogous to that of a social planner. We use the choices of the impartial participants to investigate trade-offs between efficiency and equity, and compare these with the choices of those in the self-interest condition. Our results suggest that efficiency is the most important single factor determining preferences between policy options, but decisions were influenced almost as much by equity as by efficiency. Participants in the self-interest condition favoured policies that benefited them personally, and as a result their preference for the most efficient option was weaker than for the impartial respondents. Nonetheless, self-interest was not sufficient to nullify the influence of overall efficiency. In a second study (n=793), we replicated these results, and further explored participant's concern for others in relation to the nature of the benefit. Jones-Lee (1991) established, theoretically, that incorporating this altruism in VSL estimates when it concerns others’ safety exclusively avoids double counting of the benefits of policies. However, there is a need for work disentangling safety and non-safety focused altruism empirically. Our results imply that neither taking a purely self-interested nor a purely impartial perspective will provide an accurate basis for policymaking. By quantifying the difference between 'self-interested' and 'impartial' respondents' preferences, we contribute to the debate on whose preferences should be taken into account to inform policy. Our paper offers an empirical framework that can be used to inform policy that considers these concerns and reports some indicative results from a study implementing that framework.

- **Value of a Life Year and Discounting of Conditional Risk Sequences; Rebecca McDonald, University of Birmingham**
  - Discounting is at the heart of the theoretical basis of the Value of a Life Year (e.g. Jones-Lee et al., 2015). Whilst preferences for different kinds of VOLY are now well established (Hammitt and Tuncel 2015, Nielsen et al 2010), little is known empirically about the nature of time preferences in this context. The VOLY is characterised by conditional risk sequences, because the probability of survival at time T is conditional on survival at time T-1, which in turn is conditional on survival at time T-2, and so on. However, to date, preferences over conditional sequences of risk have received remarkably little attention in the experimental economics literature, and the role of time preferences has been largely ignored. We conduct a fully incentivised longitudinal experiment (n=251) where participants face a distribution of conditional probabilities of winning Â£5.00 on four occasions over 12 weeks. The experimental incentives reflect the key features of life expectancy gains: the Â£5 prize in each period proxies for the utility of living through a period of time, and the probabilities reflect survival probabilities. As with life expectancy, surviving (i.e. winning) in an earlier period is a prerequisite for surviving (i.e. winning) in a later period.
winning) later. Following Nielsen et al. (2010), we elicit participants' preferences between different perturbations of conditional probability sequences. The first perturbation is a one-time increase in the baseline odds, which can happen in any of the four periods. The second perturbation is a constant improvement offered in all periods. The third perturbation also offers an improvement in all periods, but its magnitude is inversely proportional to the baseline probability of receiving the prize. This design allows us to estimate participants' effective discount factors directly from the trade-offs participants made between perturbations. The results reveal heterogeneity in preferences. Specifically, the proportional perturbation was preferred by 53% of participants, the immediate one-off preferred by 19%, and constant by 10% of participants. This is striking, since the different perturbations delivered identical gains in overall expected value. Less than 15% of participants offered intransitive preference orders, and 2% stated indifference between all perturbations. When considering the preference for one-off risk reductions at different times, we find no clear preference for sooner over later risk reductions. This reveals that discounting future payoffs is not the only driver of choice in this context. As such, we explore whether their separately elicited preferences over improving versus declining sequences, over risk, and over time can predict their preference. We find that participants who prefer improving sequences tend to prefer the proportional perturbation. Using the paradigm that we established in our experimental work, we are now conducting a nationally representative survey in the context of fatality risks to explore the nature of VOLEY preferences and elicit discount factors in this policy relevant context.

- Gains and Losses: Socially Costly Choices of Benefit-Cost Measures and Further Test Results of New Method to Improve; Jack Knetch, Simon Fraser University, Department of Economics
  - While there has long been near universal agreement that the monetary value of a gain is given by the maximum WTP, and a loss by the minimum WTA, the practice in most applied fields -- benefit-cost analysis included -- continues to be to use the WTP measure to assess the value of essentially all changes -- justified by the earlier theoretical and empirical evidence of their near equivalence. More recent research has provided hundreds of empirical studies revealing that people often have reference dependent preferences for many entitlements and that these, unlike an income effect, often give rise to significant disparities between the measures. Among the implications of these findings, tow are particularly relevant to the results reported here: (1) the value of changes which people seem to regard as losses, continue to be assessed with the WTP measure with little empirical support for doing so (valuing damages from oil spills may be examples), and (2) while analysts regard nearly all positive changes as gains, people seem to consider many as reductions of losses, with the WTA measure then providing more accurate assessments (and analogously for negative changes). Although better choices of measure can now be made in many cases, more general improvements would be materially aided by a better means to objectively determine which measure is more appropriate in particular cases, rather than relying on assertions and unsupported claims as is now so often the case. This would not only better determine the more appropriate choices in individual cases, but would also help in determining the extent that the choice of measure is a serious issue deserving of due attention. Current research has provided at least one potentially useful approach to such a means, based on the concave-in-the-gains, and convex-in-the-losses common characteristics of reference dependent value functions. Further tests of this method -- e.g., alternative framings of the options offered to respondents; the possible undue influence of gain
offers that completely mitigate prior losses rather than partially cover them; and the performance of the method over a broader range of changes -- have been carried out over the past year or so and will be continuing. Examples of the so far generally encouraging results will be included in this report. Considerable current evidence, including some of the results of the recent tests of the new choice method, appears to be generally consistent with the view that the current dominant practice of using the WTP measure for valuing essentially all changes (apart from some VSL estimates), may be giving rise to a general understatement bias in assessments of the values of losses and reductions of losses. To the extent that this is the case, the choice of an inappropriate measure is not, of course, a free good. The likely resulting misguidance comes with social costs -- on present evidence, quite possibly with substantial social costs.

- **When is a Dollar Not Worth a Dollar? Irrationality and the Value of Cash Transfers; Dan Acland, University of California, Berkeley, Goldman School of Public Policy**
  
  A dollar taken from a taxpayer and given to a social-welfare beneficiary is typically considered to be social-surplus neutral, as the cost to the taxpayer is exactly offset by the benefit to the recipient. It is well known that this result is confounded by the fact that the value of a dollar goes down as wealth goes up, but there is another reason to think that transfers are not social-surplus neutral. Behavioral Economics has identified many biases and judgment errors that result in irrational decision making, which causes individuals to make choices that do not maximize their 'true' or 'rational' preferences. Recent literature points to the possibility that poverty exacerbates irrationality. I show that if that is true, transferring money from taxpayers to recipients may generate a net cost to society, or a net benefit, depending on whether the transfer is enough to increase the rationality of the recipient by some significant amount. The intuition behind the proof is that a dollar spent by a recipient according to their rational preferences will generate less welfare for them, as measured by their rational utility function, than if they spent it according to their rational preferences, but that, conversely, if the transfer increases the recipient's rationality, it will cause them to not only spend the transfer more efficiently, but also to reallocate their pre-transfer budget more efficiently, potentially leading to a net increase in their welfare, relative to the case in which they simply allocate the transfer rationally. I work out a simple model of a transfer under present-bias, and parameterize the model to compute the net benefit, positive or negative, generated by a transfer of any given size. The main implication of my findings is that transfers cannot be treated as social-surplus neutral in benefit cost analysis, and that some kind of adjustment is necessary to correctly estimate the impact of transfer programs. My study contributes to the new literature on adjusting willingness-to-pay estimates under irrationality and is closely related to issues of imperfect information. In addition, my findings can be seen as a contribution to the large literature on paternalism that has grown out of Behavioral Economics. The most obvious policy implication is that a rationally balanced bundle of in-kind transfers could be superior to a cash transfer, but great caution must be exercised due to the finding that increasing rationality can increase the value of cash transfers. Furthermore, even if transfers destroy value, it is important to remember that there may be issues of autonomy, liberty, and dignity that would cause decision makers to prefer cash transfers over paternalistic in-kind transfers.
2.C Transportation, Social Welfare, and Distributional Effects
Chair: Kelly Maguire, U.S. Department of Agriculture
Presentations:

• Estimating Cost Effectiveness and Distributional Impact of Sector Investment Program in Morocco; Takeshi Daion, Waseda University, School of International Liberal Studies
  o This paper looks into the cost effectiveness as well as distributional implications of rural road sector investment program (SIP) in Morocco, which has been co-financed by multiple lending institutions and donor agencies, including the World Bank, European Investment Bank (EIB), Agence Francaise de Developpement (ADF), and Japan International Cooperation Agency (JICA). The program was intended to overcome the so-called 'fungibility' of aid assistance for developing countries, namely an unintended allocation or transfer of funds due to the gap between priorities for public investment of donors and recipients, despite earmarking. With the presence of fungibility, the aid intended to assist education ends up increasing public expenditure for roads, for example. With SIP in Morocco, donors will contribute to Road Fund who will allocate resources to road section according to Morocco's priorities. The author has conducted cost-effectiveness estimation of the rural roads invested by JICA, generating overall low internal rates of returns (around 0~5%) due mainly to low traffic volumes. The motorization rate remains still low in man rural areas. The standard Cost Benefit Analysis (CBA) methods, taking benefits as saved transportation costs for vehicles, however, misses some of the key implications or impacts of rural road infrastructure for gender empowerment. In addition to CBA, the author has conducted econometric estimation of social impacts of the SIP, using household data in both treatment and control groups (those with access to improved road or not) asking if the road investment has improved education and health goals of women, who have been treated unequally. The logit analysis suggests that there is a significant correlation between the road improvement and the increased visits to prenatal care by pregnant women, compared with those in the control group. We also conducted focus group discussion with female users of the road, many of whom confirmed their satisfaction with the improved road itself to facilitate transportation; however, the causal link between the road and educational enrollment has not been proven by both quantitative and qualitative evidence. Traditional values, based upon Islamic law, could have explanatory power for schooling, as many rural people keep traditional values against working women. The paper suggests policy implications from CBA for efficiency and econometric analysis for distribution of income and gender empowerment.

• Is It Expensive to Be Poor? The Case of Public Transport in Sweden; Henrik Andersson, Toulouse School of Economics

• Estimating Wider Economic Benefits in North America; Pierre Vilain, Steer, Alka Johri, Metrolinx, Megan Brock, Steer, Armando Orta Madero, Steer, Patrick Miller, Steer, Daniel Burke, Steer
  o Cost-benefit analysis (CBA) applied to transportation has historically focused on user benefits (principally travel time, safety and operating costs). As measurement of public
health impacts has improved, various environmental costs and benefits have also become an accepted part of the CBA tool-kit. More recently, there has been increased interest in accounting for wider economic benefits (WEBs) as part of CBA applied to transportation projects (Graham (2018)). In a world of constant returns to scale and perfect competition the CBA approach would arguably capture all benefits. However, in a world of (potential) increasing returns and localized monopoly power, there have been increasing efforts to include WEBs into appraisal practice. The concepts underpinning WEBs are rooted in a several fields of enquiry, notably urban economics. Various contributors to this field have advanced a body of theory that posits that workers and firms locating in proximity become more productive through various often overlapping mechanisms (increased information flows, faster learning, labor specialization, improved worker-firm matching and increased choice intermediate inputs). WEBs are primarily (but not exclusively) a quantification of how improved accessibility can lead to improved worker and firm productivity through agglomeration economies. Improved transport increases proximity triggering relocation of economic activity as firms and households respond to new opportunities. The productivity benefits accrue from the increased concentration of economic activity. Further the transport improvement induces increased investment resulting in agglomeration and productivity effects. Additionally, there may be impacts in the labor market, on the both the supply and demand side. A fairly extensive effort was undertaken in several European Union countries (notably the UK) to develop such estimates (Graham (2010)). The UK Department for Transport (TfL) has developed a fairly detailed guidance, including estimated parameters, to estimate the productivity benefits of investments that increase transportation accessibility. The estimated parameters from the TfL guidance have been used in appraisal in North America, though there has been some concern with applying estimates for the UK in a different context. The work described herein involved developing estimates of agglomeration elasticities for a North American context, specifically major Metropolitan areas in Canada. Canadian Census data on wages by industry summarized at a small zone level, estimates of the impact of agglomeration of workers on productivity was completed. The estimated models also quantify how agglomeration benefits decline with distance, a ‘decay’ parameter that is central to WEBs. The results reported here show clear and highly significant evidence that accessibility improvements have played a part in increasing the productivity of Canadian workers. The estimated agglomeration elasticities vary across industries, as expected by theory and observed patterns in the UK. The results also suggest that estimating WEBs parameters for specific regions or countries is warranted if one wants to include these effects in a transportation investment CBA.

  - At the Netherlands Bureau for Economic Policy Analysis (CPB) we regularly receive requests from the Dutch Ministry of Infrastructure to perform second opinions on Social
Benefit Cost Analyses (SBCA). One of them explored several options to develop a new seaport (the 'Energy port') aimed to facilitate the construction of offshore wind parks in the North Sea. The proposed location in IJmuiden is closer to most of the wind farms than the existing ports of Rotterdam and Den Helder, allowing for future cost savings in transportation of the wind turbines. The transport cost savings outweigh the construction and operating costs of the port according to the SBCA. We were asked to evaluate whether this SBCA was methodologically sound. Based on our evaluation, the SBCA methodology is flawed on two aspects, yielding a probable and significant overestimation of the projected welfare gains of constructing the 'Energy port' in IJmuiden. First of all, the SBCA states that without the 'Energy port', no wind turbine transport will take place from IJmuiden. With the 'Energy port' in place, IJmuiden would then take over all transportation needed to construct the offshore wind farms, mainly from the port of Rotterdam. Implicitly, this assumes that both transport routes are perfect substitutes, which they are not: amongst others, the smaller 'Energy port' would have much less facilities and services than the port of Rotterdam, one of the largest ports in the world. The cost advantage of IJmuiden decreases if these considerations are taken into account, decreasing the expected welfare gains from constructing the 'Energy port'. Secondly, the SBCA does not apply the 'rule-of-half' for calculating the welfare gains, which leads to another overestimation. The rule should in fact be applied if only a portion of the Rotterdam transport firms switches to IJmuiden, not all of them. This is likely to be the case, based on the previous discussion. We propose a number of changes in the methodology employed by the SBCA. The number of round trips form the current port facilities in IJmuiden is probably larger than zero because offshore wind companies are already located in the existing port of IJmuiden. Also, when calculating the decrease in transportation costs, one should compare the costs of sailing from IJmuiden before and after construction of the 'Energy port', not the difference in costs between IJmuiden and other ports. Lastly, transportation costs to the wind farms are not the only consideration when choosing a site to operate from. We propose applying the 'rule of half' when estimating the number of companies that moves to IJmuiden, instead of assuming that all of them move.

2.D Health Care Costs
Chair: Bridget Dooling, George Washington University, Regulatory Studies Center
Discussant: Sandra Hoffman, U.S. Department of Agriculture
Presentations:
• Does Medicare Part D Extend Lives-Medicare Part D and Mortality; Katherine Toran, US Food and Drug Administration
  o I analyze the impact of Medicare Part D prescription drug coverage on mortality, using the Health and Retirement Study Panel core files from 1996 to 2014. Although I do not find an impact on the life expectancy of respondents as a whole, I do find a significant positive effect for black men: an additional five months lived as a result of Part D coverage. Using a range of values for one life-year saved, I calculate the life-saving
benefit of Part D to be worth $30.4-$60.8 billion over the last decade. Based on this number, Medicare Part D was cost-effective for black men but not for the entire population, although this does not take into account the other health benefits of drug coverage. I also use several other methodologies to find a cost-benefit analysis of Part D. Overall, Medicare Part D saved 65,610 lives as of 2014, an important health gain for seniors in America.

- Emergency Department Charges Associated with Fall Injuries - An Analysis of the NEDS Data; Uma Kelekar, Marymount University
  - Falls are common and can cause serious injury among older adults. They are costly to treat. The main aim of this study is to estimate the most recent number of fall-related injuries and annual costs in the Emergency Department (ED). Nationally, based on a preliminary analysis of the E-codes (ICD-9) documented in the 2014 National Emergency Department Sample (NEDS) data, 9.36 million (approximately 7%) of the 138 million ED visits were fall-related injuries. Older adults over 65 years represented approximately one-third of the falls. The annual ED charges for these fall injuries were 25 billion, with an average charge of $3,000/visit. Of this total, 62% ($15 billion) are paid for by Medicare and Medicaid. While the majority of the visits were treat-and-release (83%), 13% resulted in an inpatient admission and there were approximately 3000 deaths. With the population of older adults only projected to increase, the number of falls and associated injuries or costs are also expected to rise. Our primary goal of this study is to estimate the number of fall-related injuries using the 2017 NEDS data [that will be released in Fall 2019]. By using bivariate analyses, we will be able to provide charges associated with fall injuries and its breakdown by various patient and clinical characteristics such as age-group, gender, disposition, type of payer, median household income and patient location. Of particular interest to the policy-makers and payers will be the cost findings associated the fall-related injuries by age-groups, specifically older adults and its financial implications on public programs such as Medicare and Medicaid. This study will use existing estimates of the effectiveness of evidence-based programs such as Matter of Balance, or Otago to highlight the potential cost-savings associated with diverting ED visits to alternative community settings.

- Estimating the cost of illness using hospital discharge data; Sandra Hoffman, U.S. Department of Agriculture
  - Human capital estimates continue to be an important method of estimating the societal cost of illness in cost-benefit and other policy analysis. Hospitalization costs are an important component of these analyses. For example, when estimating the medical treatment costs of asthma as part of an analysis of benefits for a new air pollution policy, one would need to be able to identify hospital admissions related to asthma. One of the primary data sets used in the U.S. to estimate these costs is the Agency for Healthcare Research and Quality’s (AHRQ) Healthcare Cost and Utilization Project (HCUP) data. These databases collect charges from a representative sample of hospitals in all U.S. states. A fundamental step in estimating hospitalization costs is quantifying the number of admissions due to the disease in question. Hospital billing departments
use International Classification of Disease (ICD) diagnosis codes in assessing charges when upon discharge. These codes can be used to identify hospitalized patients with a given disease listed on the discharge record. More than 21 ICD diagnosis codes can be listed on the discharge record, including a principal (primary) diagnosis code, which is supposed to represent the primary reason for the hospitalization. Some hospitals also record the reason for admission, which may be different from the primary reason for the hospitalization. Despite the pivotal importance of estimating hospitalization cost, there is no agreement on best practices for quantifying the number of admissions due to a given disease. Some researchers use the principal diagnosis code only, whereas others use the first 2 or the first 3 diagnosis codes. Moreover, there is a lack of research examining how the number of diagnosis codes chosen impacts the resultant hospitalization cost estimates for a given disease or acute complications from that disease. In this paper, we explore the sensitivity of hospitalization costs estimates to four alternative strategies currently used by health economists for quantifying the number of hospital admissions due to a disease, using Salmonella as an example. We compare hospitalization costs estimates for Salmonella (overall and with and without sepsis) using (1) the principal diagnosis code only, (2) the first two diagnosis codes, (3) the first three diagnosis codes, and (4) using all diagnosis codes. We also conduct a case study of correspondence between reason for admission and the principal diagnostic code.

- The Effect of Hospital-Physician Integration on Hospital Costs; Damien Sheehan-Connor, Wesleyan University
  - This study evaluates whether hospital costs are lower when hospitals are integrated with physician practices than when they are not, using a large sample of U.S. hospitals from 2000-2013. Greater coordination of care between hospitals and providers has been widely considered a useful way to increase the efficiency of health care provision by lowering costs and/or improving quality. This principle underlies important health care reform policies, particularly the incentives for Accountable Care Organizations provided as part of the Patient Protection and Affordable Care Act. Even so, there is very little direct evidence about whether integration lowers hospital costs and theoretical predictions are also unclear. Countervailing economic theories predict that vertical integration may lead to either lower or higher costs. This paper provides estimates of the impact of hospital-physician integration using a Cobb-Douglas cost function and hospital fixed effects following the approach of Cuellar and Gertler (2006), but using a much larger and more recent sample of hospitals. The results suggest that hospital-physician integration is not associated with lower hospital costs and that there may even be a slight increase in costs when hospitals are integrated. In addition, there is little evidence of a statistically significant relationship between the quality of hospital care and hospital-physician integration. This suggests that the lack of reduction in hospital costs from vertical integration is not due to higher quality but potentially to costlier care. Finally, we do not find evidence that hospital-physician integration is associated with a greater volume of hospital patients, higher hospital revenues, or
higher operating margins. These results suggest that caution is warranted when predicting cost savings associated with hospital-provider integration.
### 2. E Food and Agriculture Presentations

**Chair:** Linda Abbott

**Presentations:**

- **Economic Evaluation of an Early Childhood Development Center? Based agriculture and nutrition intervention in Malawi; Aulo Gelli, International Food Policy Research Institute**
- **Appraising the Costs and Benefits of Reform to Delivery of Regulatory Controls of UK Food Businesses; Lea Milanovic, Food Standards Agency, United Kingdom**
  
  - Malnutrition is a leading cause of premature death and disability among children in Malawi and other low-income countries. Agricultural programs and other nutrition-sensitive interventions have demonstrated promising effectiveness in increasing consumption of nutritious foods and improving dietary quality among vulnerable children and families. Integration of these programs into other sectors and platforms (e.g., health, education) may have synergistic effects, improving feasibility and effectiveness by leveraging available resources. In Malawi, a recent, rigorous randomized trial found that an integrated agriculture and nutrition intervention, delivered through an early childhood development center (ECD)-based platform, improved child diets and reduced rates of stunting during a twelve month period. Evidence on the cost and cost-effectiveness of such multi-sector, integrated, nutrition-sensitive programs is limited globally, though such evidence will be critical to motivating future investment in and long-term sustainment of these programs.
- **Using public comment on regulatory reform (EO 13771) requests to identify regulations that affect productivity. Daniel Perez, Zoey Xie, and Mark Febrizio, George Washington Regulatory Studies Center**
- **Distribution, Impacts and Cost-Effectiveness of Strategies to Limit the Spread of Red Imported Fire Ants in the US; Paul Mwebaze, University of California, Davis**
  
  - Since its introduction to Mobile Alabama in 1930, the Red Imported Fire Ant (RIFA), solenopsis invicta has spread to more than 367 million acres across 14 mostly southern states. RIFA has significant impacts on agriculture and natural resources by damaging crops, agricultural equipment and wildlife. It also imposes serious nuisance and human health impacts. The experience of RIFA invasions in other countries indicates that the most cost-effective strategies consist of prevention, early detection (e.g. New Zealand) and rapid response treatment programs. Ideal management decisions depend on a clear understanding of the type and scale of damages incurred from RIFA, which is currently lacking. Here, we propose to look across all states currently invaded and estimate the impacts to (1) property owners through property values, (2) individuals through health outcomes, and (3) ecosystems via impacts on bird populations. Sufficient analysis does not yet exist for characterizing the comprehensive economic impact of RIFA. Hence, there is a need to leverage spatially disaggregated data to estimate the costs associated with RIFA invasions. We address this need by developing region-specific estimates for RIFA impacts across all US states currently invaded using existing data on the spatial extent of the invasion over time. This information will be linked to datasets on socioeconomic and ecological outcomes of interest (human health, property prices and ecological [bird] surveys). Our overall objective is to estimate and document the economic and biological severity of RIFA invasions and identify the most cost-effective
strategies to limit the spread and damage from RIFA in the future. We use data collected consistently over a long-time horizon to capture historical invasion, spread and impacts across the US. An econometric analysis was conducted, using panel data (collected over time and differentiated by region) on residential property values in affected states, to determine whether there is a significant drop in property values associated with RIFA infestation. Using a difference-in-difference method, we test the hypothesis that increased use of pesticides from RIFA control has negative impacts on bird populations and human infant mortality. This work will benchmark the economic benefits and costs of strategies to limit RIFA spread. The results will characterize the costs and benefits of control strategies against RIFA. In this talk, we present preliminary results and discuss the implications, and further work required.

2:00 pm – 3:30 pm   Session 3

Chair/ Discussant: Lisa A. Robinson, Harvard T.H. Chan School of Public Health
Presentations:

• The Social-Welfare-Function Framework: An Overview; Matthew Adler, Duke University School of Law
  o The social welfare function (SWF) framework is a systematic methodology for policy analysis, which originates in theoretical welfare economics and is widely used in some bodies of economic scholarship such as optimal tax theory and climate economics. Unlike benefit-cost analysis (BCA), the SWF framework is sensitive to the diminishing marginal utility of money and therefore can take account of the distributive impacts of governmental policies. This panel will describe the SWF framework and how it differs from BCA, both in general and in application to specific types of governmental policies. The first presentation will be an overview of the framework. The second presentation will discuss the use of SWFs to value mortality risk reduction policies. The third presentation will discuss SWFs and vaccination policy.

• Valuing Mortality Risk Reduction Using Social Welfare Functions; James Hammitt, Harvard T.H. Chan School of Public Health
  o Reductions in mortality risk are usually evaluated using the ‘value per statistical life’ (VSL). Under standard theory, VSL is expected to vary across individuals who differ in wealth, baseline mortality risk, and other dimensions such as age. In practice, however, it is common to use the same VSL for all affected individuals. The reluctance to allow VSL to vary across individuals reflects the tension between efficiency and distributional concerns; conventional BCA measures allocative efficiency, setting distributional concerns aside on the assumption they will be addressed through supplementary distributional analysis. In contrast to conventional BCA, SWFs can account for concerns about equitable distribution of benefits. We present and describe the results of recent analyses of the effects of using SWFs to characterize the value of reducing mortality risk through health and safety policies.

• Social Welfare Functions and the Value of Vaccination; JP Sevilla, Harvard T.H. Chan School of Public Health
  Vaccination reduces an individual’s mortality and morbidity risks, which in turn yields economic benefits like greater work productivity and protection from the financial risks of
illness. The magnitudes and incidence of these health and economic gains vary across individuals’ lifecycles and by individuals’ baseline health and wealth. In the distribution of these health and economic gains, national-level decision makers like publicly-financed health-sector payers and finance ministries may give priority to the worse off defined in terms of either well-being or health. Global decision makers like non-profit funders of R&D face the issue of comparing and weighing health and economic gains to populations with drastically different levels of baseline health and wealth. We explore economic evaluation methods that combine health-augmented lifecycle models to address intrapersonal valuation issues and social welfare functions to address national and global interpersonal ones.

3.B Challenges in Public Decision Making
Chair/Discussant: Steve Lize, The Pew Charitable Trusts
Presentations:

- Mixing Water and Economics in the Upper Midwest is like Mixing Water and Oil; Joshua Erickson, North Dakota State University
  o Water—too much or too little—is an ongoing issue in the Upper Midwest. There are currently hundreds of organizations (local, federal, government, and non-government ‘NGOs’) that manage, regulate, or promote various aspects of water use in the Red River Valley of northwest Minnesota. Not surprisingly, economic efficiency has received little, if any, attention in proposals to manage the region’s water. A recent (2017) federal grant was allotted for planning 20 distributed storage sites (DSS) for Red River of the North flood control. As the grant mandated the use of Federal guidelines (P&G/NRCS) regarding benefit-cost analysis, a prototype study was completed on a typical DSS, which resulted in a revelation of the economic efficiency (not very good!) of such projects. The sponsoring, local water management agency did not want the results to be made public and held up publication of the prototype study for over a year. This paper looks at the history of water management organizations in the area; explores why there is such avoidance of, or even animosity toward, economics; and presents the strikingly-similar results of an ex post BCA of another DSS project (as conducted by the authors). It also raises the question of "How can we demonstrate that economics is not the enemy?"

- Measuring What Matters in Public Procurement Law: Efficiency, Quality and More; Desiree Klinger, Yale Law School
  o Modern public procurement regulations—such as the U.S. Federal Acquisition Regulation (FAR), the EU Public Procurement Directives, and the Swiss Public Procurement Act—are based on a set of common principles: transparency, equal treatment, non-discrimination, competition and efficiency. Recent revisions of these regulations have disrupted the structure and introduced new concepts, most importantly sustainability and integrity. Legislators, purchasing agencies and courts are now confronted with new conflict of interests, which often ask for mandatory trade-offs. But so far, no comprehensive method to weight and assess these principles and goals have been developed for government contracting. This Paper aims to stress the need for regulatory impact assessments to better understand the real-life consequences of public procurement regulation, especially considering its large economic dimension accounting to 10-15% of national GDP. It offers a short overview of existing impact assessments,
their application and respective advantages and drawbacks with a view on public procurement law. Against this backdrop, this Paper suggests two evaluation frameworks and defines a set of parameters to measure the economic benefits of procurement regulation and their effectiveness in achieving defined procurement goals. As a first best solution the Paper suggests a cost-benefit analysis with metrics to quantify and monetize public procurement benefits. As a second-best solution it designs a multi-objective decision matrix for contracting officers to select the optimal award mechanism, which helps balancing the different-conflicting-economic and non-economic procurement goals by weighting the goals, rating the different regulatory options and identifying the preferred option. Overall, this Paper informs the legal debate on better procurement regulation, suggesting a 'more economic approach' to evaluate the effects of government purchasing on the economy and society for different national and regional procurement regimes.

• Transparency in Agency Benefit-Cost Analysis; Caroline Cecot, *George Mason University, Antonin Scalia Law School*
  
  Benefit-cost analysis (‘BCA’) is widely used in agency decisionmaking, summarizing the impacts of an agency’s chosen policy. As agency rulemakings have increased in quantity and importance, there has been renewed interest in increasing decisionmaking transparency, especially with respect to the models and data that underlie BCA. Such proposals have been highly controversial, in stark contrast to earlier efforts that received bipartisan support. At least some of the controversy can be attributed to limited information about the usefulness of this type of transparency. This Article contributes to this debate by evaluating the current level of transparency in BCA and proposing improvements to that baseline. First, it identifies two key dimensions of transparency in BCA--process and policy transparency--that allow interested parties to scrutinize agency action and hold decisionmakers accountable. Second, it objectively evaluates the process and policy transparency of a set of recent BCAs for significant rules issued between October 2015 and September 2018 using a scorecard methodology. The Article finds that many agency BCAs lack basic process transparency, meaning disclosure about their creation and their role in the decisionmaking process. In addition, many BCAs continue to lack transparency about policy impacts, failing to quantify and monetize categories of costs and benefits. Among BCAs that do monetize costs and benefits, many do not make their data, models, and underlying sources readily available. In light of the poor baseline level of transparency in agency BCA, this Article identifies the low-hanging fruit, or most cost-effective measures, that could promote meaningful transparency in BCA that would undeniably do more good than harm.
3.C Assessing Large Infrastructure Investments

Chair: Henrik Andersson, Toulouse School of Economics
Discussant: James Gillespie, Virginia Transportation Research Council

Presentations:
  - We use scenario analysis and robust decision making to assess the economic feasibility of investments to reduce the risk to the low-lying and densely populated island Ebeye's population and assets from inundation following swell waves, typhoons, and tsunamis. Two options were considered: (1) a standard revetment of 1,060 meters length, and (2) a revetment with a berm which would offer more protection but require a larger amount of aggregates. The cost of the investments were highly uncertain due to the need to source the necessary aggregates from large thousands of miles away and lack of precedence. The benefits would be the incremental avoided tangible and intangible losses compared with no-project conditions, which could be partially estimated using probabilistic models. Specifically, for each investment option, we estimated the expected annual damages (EADs) from inundation from 1/1, 1/5, 1/10, 1/30, 1/50-year weather events. However, inundation levels and hence EADs would vary significantly among different sea level rise levels, which are deeply uncertain. Additional significant uncertainty existed about the level of population growth on the island. Finally, the discount rate was also treated as an uncertain variable. We sampled the uncertainty space created by the uncertain variables into 2,000 cases using Latin Hypercube Sampling. The cost-benefit analysis was then run for both options in each of the 2000 cases, generating metrics for economic feasibility, including net present value (NPV). Next, using scenario discovery algorithm we explored under which conditions the NPV of either option would be negative, based on the results for the 2,000 cases. We found that for option 1, the conditions most predictive of a negative NPV is a discount rate (d) higher than 10% combined with a cost of aggregates higher than 170% than the base case estimate. Eighty-nine percent of the cases with a negative NPV correspond to these conditions and 79% of the cases that correspond to these conditions have a negative NPV. The quasi-p values for these conditions are also very low, meaning that these results are statistically highly significant. In other words, if those two conditions are not met together, the NPV of option 1 is positive, regardless of the values the other the other uncertain variables, including SLR level. Since 10% is a very high social discount rate for a country like Marshall Islands with a long-run per capita GDP growth rate averaging around 1 percent, we concluded that there is very little risk of a negative NPV and option 1 was robust. We found similar results for option 2. This time, for NPV to be negative d had to be higher than 9% combined with cost of aggregates being higher than 170% of the base case estimate. Eighty-five percent of the cases with a negative NPV correspond to these conditions and 77% of the cases that correspond to these conditions have a negative NPV. The quasi-p values for these conditions are also very
low, indicating high statistical significance. Nevertheless, option 1 was economically more efficient than option 2 in all 2,000 cases.

- Applying Resiliency to Cost-Benefit Analyses for Maritime Port Infrastructure; Christopher Eshleman, *Port Authority of New York and New Jersey*, Daphne Federing, HDR
  - EPL is a State-Owned Enterprise created by Law n.º 12743 from December 2012. EPL is under the authority of the Ministry of Infrastructure. EPL is responsible for the development of a National Logistics Plan (PNL) that will allow integration of infrastructure investments, operations, services and the network of roads, railways, ports, airports and waterways, and its prioritization. PNL will identify bottlenecks and investment opportunities in the short, medium and long term, in order to provide seamless and efficient movement of inputs and finished goods across the country. The plan will also propose solutions that tie infrastructure and services to address public needs as well as private goals. Building large infrastructure is a very difficult undertaking. Historically, the development of infrastructure in Brazil has been subject to strong political interference. To separate the purely political issues (that may be legitimate) from economic and technical aspects, EPL developed a Cost-Benefit Analysis (CBA) methodology. The Cost-Benefit Analysis (CBA) is an analytical tool that shall be mandatory for the appraisal of major infrastructural projects to measure the benefits and the costs of the projects to society thereby contributing to Brazilian strategic policy objectives. The purpose of the CBA is to facilitate a more efficient allocation of resources by providing evidence of the advantages of a particular option in respect to other alternatives. EPL's CBA framework, supported by detailed and objective technical information, will improve investment decisions in relation to decision-making based purely on political interests, poorly defined objectives or wish-lists. EPL uses a CBA methodology to support transport infrastructure investments for the first time in Brazil. EPL's CBA framework considers the social benefits and investment and operational costs accounting for travel time, safety, vehicle operating costs, and carbon emissions' benefits, among others. All these social benefits can be monetized for road, rail, ports, airports and waterways, as well as for multi-modal projects. EPL prepared an initial case-study using the CBA methodology to compare three competing greenfield projects (road, rail and waterway) for the transport of soybean produce from Midwest to the North of Brazil. The baseline scenario used was a single carriageway road. Finally, EPL also prepared and published a Guide to Cost-Benefit Analysis of transport investment projects and a related table of coefficients on its website, granting free access to any Brazilian national. The EPL's CBA framework will also be used by the Brazilian Government to rank the projects in the portfolio of the PNL.

- The Economics of Physics: Social Cost-Benefit Analysis of Large Research Infrastructures; Chiara Pancotti, *CSIL – Centre for Industrial Studies*
  - In economics, ‘infrastructure’ is a long-term investment aimed at the delivery of essential services to a large number of users, such as those in the field of transport, energy, or telecommunications. A research infrastructure (RI) is a single-sited, distributed, virtual, or mobile facility, designed to deliver scientific services to
communities of scientists. In physical sciences (including astronomy and astrophysics, particle and nuclear physics, analytical physics, medical physics) the RI paradigm has found several large-scale applications, such as radio-telescopes, neutrino detectors, gravitational waves interferometers; particle colliders and heavy-ion beams; high intensity lasers, synchrotron light sources, spallation neutron sources; hadrontherapy facilities. Since these projects are costly and ultimately funded by tax-payers, two questions arise: Which project should a government target for funding in the first place? What are the benefits for society of supporting these investments and their operations? Governments and taxpayers - when government funds are involved - but also private donors or investors of private funds, are mostly interested in knowing (or should be informed about) the expected or achieved socio-economic impact of investment decisions they support. While some socio-economic impact studies of RIs in physics have been available since the 1980s, the intangible nature of some benefits and the uncertainty associated with scientific discoveries have limited the diffusion of CBA in this field until recently. Nevertheless, recent studies have explored the application of CBA to RIs in physics. Moreover, the European Commission, the European Strategy Forum on Research Infrastructures, the European Investment Bank, and some national authorities suggest that the study of social benefits and costs of RIs should be part of the process leading to funding decisions. The presentation draws from a recent article published on Oxford Research Encyclopedia of Physics which deals with the application of social cost-benefit analysis (CBA) to assess RIs in the field of physics. More specifically the presentation will focus on the valuation of social intertemporal benefits. It will be argued that it is convenient to divide them into two broad classes. The first class of benefits accrue to different categories of direct and indirect users of infrastructure services: scientists, students, firms benefitting from technological spillovers, consumers of innovative services and products, and citizens that are involved in outreach activities. The empirical estimation of the use-value of a RI depends on the scientific specificities of each project, as different social groups are involved to different degrees. Secondly, there are benefits for the general public of non-users: these benefits are associated to social preferences for scientific research, even when the application/use of a discovery is unknown. In analogy with the valuation of environmental and cultural goods, the empirical approach to non-use value aims at eliciting the willingness-to-pay of citizens for the scientific knowledge that is created by a RI. This can be done by well-designed contingency valuation surveys.

- Static and Dynamic Agglomeration Calculations for Benefit-Cost Analysis; Daniel Graham, Imperial College London
  - Existing Transportation BCA calculations often include valuation of wider economic impacts (WEIs) that arise due to market imperfections. Agglomeration effects are thought to be the largest of the WEIs that arise from spatial market imperfections and are typically quantified using an approach in which transport schemes are deemed to induce changes in the generalised cost of travel, but not in the spatial distribution of land uses, which is assumed to remain fixed before and after the scheme. This so called 'static agglomeration' calculation clearly involves a major simplifying assumption. In this
paper, we investigate the implications of this assumption via a study of the impact of a
new metro line, the Jubilee Line Extension (JLE) in London, on firm location and
productivity. We do so using a causal methodology for ex-post evaluation of the
scheme. We find substantial evidence of firm displacement and re-location as a result of
the JLE, and we use this evidence to develop a ‘dynamic’ methodology to incorporate
displacement in the calculation of WEBs of agglomeration. Our calculations indicate that
by ignoring dynamics agglomeration effects will tend to be overestimated, in our case
by approximately 10%.

3.D Challenges and Successes in Conducting Studies of Costs and Benefits of Federally Funded Health
Policies and Programs
Chair: Sue Hamann, National Institutes of Health/NIDCR
Discussant: Patrick Richard, F. Edward Hebert School of Medicine, Uniformed Services University
Presentations:
• Economic Assessment of Benefits of Research on Work-Related Injury and Illness: Learning from
Six Case Studies; Tim Bushnell, CDC/National Institute for Occupational Safety and Health
  o The National Institute for Occupational Safety and Health conducts and supports
research that assesses burden, investigates causes, and develops methods of preventing
work-related injury and illness. Drawing from experience with six case studies of the
economic benefits of NIOSH research activities conducted by the RAND Corporation,
lessons will be drawn about the strategies and data needed to conduct these kinds of
studies, as well as the potentials for conducting case studies for a wider range of
activities. The subjects of the case studies were selected based in large part on
predicted feasibility, and with a goal of case study diversity along several dimensions,
such as industry setting, type of research, type of health and safety hazard, and type of
prevention activity. While a general framework for analysis was constructed and
employed, the case studies provide an initial view of the variety of analytical approaches
needed to estimate benefits, and of the various types of challenges in acquiring and
analyzing data. Specific topics will include 1) challenges in constructing baseline
measures for exposure, risk, or injury/illness outcomes, 2) alternative approaches to
estimating the effectiveness of hazard reduction, 3) joining exposure and prevention
activity data with available data on risk and intervention effectiveness, and 4) allocating
a share of the responsibility for estimated injury or illness reduction to NIOSH activities.
Given the challenges and requirements for constructing reasonably sound estimates of
economic benefits of NIOSH activities, the potential and limitations for applying these
methods to a wider range of NIOSH activities will be discussed.
• Economic Assessment of the Benefits of Occupational Safety and Health Research: A Case Study
  on Ambulance Re-Design; Brian Quay, CDC/National Institute for Occupational Safety and Health
  o Over the last three years, the National Institute for Occupational Safety and Health
  (NIOSH) has contracted with the RAND Corporation to estimate the benefits of six
different NIOSH research initiatives. Three of the case studies were published by RAND
in December 2017, and three are scheduled for publication in December 2019. This
presentation will discuss the research process and results of one of the more recent case studies: the economic assessment of benefits of improved ambulance design. In the early 2000s, NIOSH began conducting research on the hazards associated with the interior design of ambulance patient compartments. This research eventually led to several design improvements: new seats with higher crash test ratings, improved restraint systems, and changes made to the location of equipment in order to limit head-strikes and increase the workers’ usage of restraints. These design improvements were incorporated in purchasing standards that are used widely in the US. To conduct the first three case studies, RAND developed a general analysis framework, comprised of the following steps: 1) Construct a timeline of NIOSH activities and stakeholder actions that were related to the research itself and subsequent prevention activities, 2) Estimate the number of workers affected by the relevant prevention activities, 3) Estimate the reduction in exposure these workers experienced, 4) Estimate the number of avoided injuries, illnesses, and fatalities, 5) Attribute a share of illness and injury reductions to NIOSH, and 6) Monetize avoided injuries, illnesses, and fatalities. This presentation will explain in detail how this general framework was adapted and implemented to estimate the economic benefits of NIOSH research on the re-design of the patient compartment of ambulances.

- Assigning Attribution in Economic Impact Studies of Biomedical Research; Sue Hamann, National Institutes of Health/NIDCR
  - Empirical approaches to attribution are neither well-defined nor frequently attempted. Considerable work lies ahead in articulating both the state of the art and the state of the practice of attribution analysis in outcome evaluation, particularly biomedical research outcome analysis. Models from multiple fields do exist. In regard to evaluating the outcomes of federal funding to large biomedical and science centers, a leading evaluator stated, “In funding science and technology...it’s extremely hard to tell whether [the funding agencies’] actions produce an improvement. Any kind of control group is absurd, and comparison groups that are reasonably comparable are not to be found” (Scriven & Coryn, p. 101, The logic of research evaluation, in C.L.S. Coryn & M. Scriven (Eds.), Reforming the evaluation of research. New Directions for Evaluation, 118, 89-105, 2008. Michael Scriven (2008) advanced a model for attribution analysis in big science evaluation that he labeled a progression discontinuity design. This model relies on multiple panels of experts and scientists, external and internal to large research centers, to determine whether discontinuity, that is, “significant acceleration in the rate or excellence” of research, has occurred and identifying specific structural elements of the research center in question that were responsible for the acceleration. Using the Scriven method, it is plausible that one could address the typical economics question of what marginal benefit could be derived from an additional dollar of federal funding to a large research center. We note, that in the specific case of biomedical research, the impact of the research findings on clinical practitioners is crucial and would have to be measured separately from the impacts on researchers. Researchers from other fields
such as data analytics and economics have also put forward attribution models or suggestions.

3.E Roundtable Discussion: Analyzing and Presenting the Uncertainty in Benefit-Cost Analysis
This panel examines how to understand and convey both the bottom-line findings of a benefit-cost analysis and the level of certainty decisionmakers should place in those findings. The panelists come at this issue from a variety of perspectives, including that of the decisionmaker and the analyst supplying the results. The panel will cover benefit-cost analysis in the context of regulatory impact analyses and social program evaluations. The panelists will share innovative ideas about tools for assessing uncertainty and effective approaches for presenting results to time-constrained decisionmakers.
Chair: Craig Thornton, Mathematica Policy Research, Inc.
Panel:
• Susan Dudley, George Washington University Regulatory Studies Center
• Nancy Bergeron, Measurement Canada & CBA Community of Practice of the Community of Federal Regulators
• David Long, Princeton Policy Associates
• Clark Nardinelli, Past President, Society for Benefit-Cost Analysis
• Randall Lutter, University of Virginia

3:30 pm – 3:45 pm Break
3:45 pm – 5:15 pm  Session 4

4.A Perspectives on Equity

This panel examines how to understand and convey both the bottom-line findings of a benefit-cost analysis and the level of certainty decisionmakers should place in those findings. The panelists come at this issue from a variety of perspectives, including that of the decisionmaker and the analyst supplying the results. The panel will cover benefit-cost analysis in the context of regulatory impact analyses and social program evaluations. The panelists will share innovative ideas about tools for assessing uncertainty and effective approaches for presenting results to time-constrained decisionmakers.

Chair: Craig Thornton, Mathematica Policy Research
Discussant: Bridget Dooling, George Washington University, Regulatory Studies Center

Presentations:

- Can Cost-Benefit Decisions be Made More Humane? Adam Finkel, University of Michigan
- Decision Processes Matter; Howard Shelanski, Georgetown University Law
- Can We Efficiently Compensate “Losers”? Craig Thornton, Mathematica Policy Research
- Accounting for Equity in RIAs; Richard Benware, U.S. Environmental Protection Agency

4.B Valuing Greenhouse Gas Reductions

Chair/Discussant: Jeremy G. Weber, Council of Economic Advisers

Presentations:

- The Environmental Co-Benefits of Low Carbon Policy in China; Bing Zhang, Nanjing University
  - Carbon trading is considered a strategy for reallocating carbon permits and reducing abatement costs that may also change energy consumption and the distribution of atmospheric pollution emissions, resulting in environmental health benefits or damage on a regional scale. In this research, we constructed a national carbon emissions trading market of the power sector to simulate the key atmospheric pollution emission patterns and the corresponding environmental health effects. We found that compared with a command-and-control policy, a carbon trading policy was able to reduce the carbon abatement costs by approximately 63.53 RMB/ton while synergistically reducing PM2.5 by 1.55 million tons and decreasing all-cause mortality by 45,200 cases, thereby generating 307.07 billion RMB in environmental health benefits and accounting for 0.52% of the nation's gross domestic product (GDP). However, compared with the command-and-control policy, carbon trading also changed the pollution emission distribution among the regions and resulted in increased air pollutant emissions and corresponding environmental health damage in certain regions.

- Option Value and the Social Cost of Carbon; Alexander Golub, American University
  - Scientists and economists have long recognized that significant uncertainties and irreversibility characterize climate change. And yet, the social cost of carbon (SCC), the preeminent policy tool to address climate change, does not include the option value (OV) that arises due to these characteristics. We demonstrate a simple methodology for approximating the OV underlying the SCC using the Bachelier formula. The policy is made with substantial uncertainty underlying the benefits and costs of climate action.
These uncertainties permeate each step of the climate-economic modeling process: socio-economic and emissions scenarios; climate models; climate damage functions; and social welfare functions. Using various methodologies, economists have developed extensive literature studying the impacts of this uncertainty on climate policy. We apply real options analysis using the output from the 2016 IWG to demonstrate the simplicity of our approximation method for OV. Using a rough approximation of the OV portion of the SCC, we find evidence that current SCC estimates represent significant underestimates due to a failure to model the irreversibility of marginal GHG emissions. We demonstrated that OV is a significant portion of the official U.S. SCC estimate at 72%. The SCC share is more sensitive to the choice of IAM model than to the specific climate scenario or discount rate. As the SCC's OV is part of the SCC, not a separate value to be treated independently, climate economics can no longer ignore this large part of the marginal cost of GHG emissions. If analysts/modelers disagree with the assumptions underlying our approximation methodology, the large magnitude of our estimates still demonstrates the pressing need for them to develop alternative calculation methodologies. The approximation method applied here can also be used in alternative policy contexts, such as oil and gas leasing decisions in the outer continental shelf. Currently, the Bureau of Ocean and Energy Management (BOEM) accounts for the OV corresponding to oil price uncertainty. However, they exclude the OV corresponding to catastrophic oil spills even as the agency increases environmental risks by opening the Arctic National Wildlife Refuge for drilling. A 2015 D.C. Circuit ruling (Center for Sustainable Economy v. Jewell) supports BOEM's omission unless a numerical methodology to estimate OV corresponding to non-market risks becomes readily available in the literature. This paper demonstrates a potential methodology.

- **Between Two Worlds: Methodological and Subjective Differences in Climate Impact Meta-Analysis; Peter Howard, Policy Integrity, New York University School of Law**
  - In his 2019 Nobel Prize acceptance paper, William Nordhaus (2019) highlighted the uncertainty over climate damages by using two completely different damage functions: Nordhaus and Moffat (2017) and Howard and Sterner (2017) [referred to as HS and NM from this point forward]. Despite their vastly different implications for climate policies, both were estimated using the meta-analysis technique: a method long considered the objective and scientifically rigorous way for combining results from multiple studies to develop a consensus estimate. By replicating the NM results starting with the HS data and methods, this paper demonstrates that this disparity stems from both differing methodological decisions (with respect to addressing omitted variables, heteroscedasticity, and clustering) and subjective decisions (with respect to data search, selection, and weighting). We then aim to resolve this disparity. Applying best methodological practices to the combined NM and HS data results in an estimate between these two polar estimates, though more in the direction of HS. Specifically, we control for the inclusion of market, non-market and catastrophic impacts and apply an inverse-temperature weight to address heteroscedasticity. The preferred specification implies damages of approximately 5% to 8% of GDP for a 3°C increase, depending on
the inclusion of catastrophic impacts. The result is relatively robust to alternative data selection, weighting, and methodological assumptions. Subjective differences between the weighting assumptions of these two earlier studies are still unresolved. To address this subjectivity, this paper makes transparent existing weighting rules (in HS and NM) and develops new weighting rules. Specifically, this paper combines method, study, and estimate-specific weights to account for differences in quality, uncertainty, and informational content. Operationalizing these rules, our preferred specification implies that total damages (including a risk premium for catastrophic impacts) are approximately 7% of GDP for a 3Â°C increase. These results are highly robust to a variety of assumptions, and we find a range of outcomes between the NM and HS estimates with a central tendency towards HS.

- The Effect of Climate Change on the Size and Costs of Wildfires: Evidence from Wildfires in U.S. National Forests; Dallas Wood, RTI International
  - In recent decades, wildfires on U.S. Forest Service (USFS) land in the United States have grown significantly larger (more than doubling since 1985). One reason wildfires have grown larger is weather conditions have been altered by Global Climate Change. The goal of this paper is to answer three research questions: 1) how much do changes in temperature and precipitation influence observed wildfire size, 2) why do changes in temperature and precipitation influence wildfire size (is it because they make fires harder to suppress, because they increase the flammability of forest fuels, or both), and 3) what will the consequences of climate change be for the size and costs of future wildfires.


As part of the U.S. Department of Transportation's (DOT's) priority on innovation in transportation, the DOT and the Federal Aviation Administration (FAA) are taking steps to integrate civil and public Unmanned Aircraft Systems (aka 'drones') into the national airspace system. The DOT and FAA have launched pilot programs and new policies and regulations enabling drone operations in a variety of economic activities while balancing risks to public safety. The future is here: unmanned aircraft package delivery has begun and plans for urban air mobility (air taxis) are coming soon.

In this roundtable, economists from the FAA, DOT and other organizations will discuss the economics of unmanned aviation, the role of enabling policies and regulations, challenges for benefit-cost analysis, and balancing tradeoffs between safety risks and expanding economic opportunities.

Chair: Nellie Lew, Federal Aviation Administration

Panel:
- Deborah Aiken, Department of Transportation
- Jennifer Baxter, Industrial Economics, Inc.
- Todd Steiner, Federal Aviation Administration
- Jeff Wharff, Federal Aviation Administration
4.D Health Valuation of Morbidity


Discussant: Kelly Maguire, *U.S. Department of Agriculture*

Panel:


- Do Preferences to Reduce Health Risks Related to Air Pollution Depend on Illness Type? Evidence from a Choice Experiment in Beijing, China; Henrik Andersson, *Toulouse School of Economics*

- Eliciting Willingness to Pay for Improved Dental Health; Stephen Resch, *Harvard School of Public Health*
4.E Innovative Benefit-Cost Applications

Chair/Discussant: Glenn Jenkins, Queen’s University and Eastern Mediterranean University

Presentations:

- Assessing the Cost of Disaster Recovery and Funding for the Puerto Rico Economic and Disaster Recovery Plan; David Metz, RAND Corporation
  - On September 19 and 20, 2017, just two weeks after Hurricane Irma, Hurricane Maria caused widespread destruction across Puerto Rico significantly damaging local infrastructure and interrupting the provision of essential services. On February 8, 2018, Congress enacted the Bipartisan Budget Act of 2018 (Public Law 115-123). The act required the governor of Puerto Rico, in coordination with the Federal Emergency Management Agency (FEMA), the U.S. Department of the Treasury, the U.S. Department of Energy, and other federal agencies with responsibilities under the National Disaster Recovery Framework, to submit a report to Congress within 180 days that described Puerto Rico’s economic and disaster recovery plan. Under contract with FEMA, the Homeland Security Operational Analysis Center (HSOAC), a federally funded research and development center (FFRDC) operated by the RAND Corporation, provided substantial support in developing the plan by soliciting and integrating inputs from a wide variety of stakeholders, contributing analysis, and assisting with drafting the plan. On August 8, 2018, the government of Puerto Rico submitted to Congress its recovery plan laying out the priorities, goals, and expected outcomes of the recovery effort. The plan included a damage and needs assessment; a set of 276 courses of action (COAs); and cost estimates and potential funding mechanisms for each COA. This presentation is intended to provide insight into the cost and funding analysis of the recovery planning process. A primary challenge was the sheer diversity of the activities included in the plan, which is due to the substantial number of COAs, their sectoral specificity, and the technical complexity of infrastructure and other investments. HSOAC’s sector-based teams, in collaboration with external subject matter experts and stakeholders in Puerto Rico, identified and evaluated potential solutions, estimated rough-order-of-magnitude costs, and identified potential funding sources. This iterative and collaborative planning process provided the basis for developing the recovery plan, with the final decisions on the content of the plan made by the governor of Puerto Rico. The entire process was completed in less than six months. Cost analysis plays two roles in recovery plan development. First, once the plan is finalized, cost estimates inform policymakers of the level of resources needed to implement it. Second, COA-specific cost estimates and cross-COA comparisons can directly support prioritization of resources. The cost estimates are intended to support high-level planning as decisionmakers balance costs against expected benefits in selecting COAs. A primary goal was to ensure the relative resource challenges of the 276 COAs were faithfully represented so that subsequent analysis and selection of COAs could be done on a consistent cost basis. This presentation answers the questions: (1) how can preliminary cost estimates for
disparate recovery actions after a disaster be done on a consistent basis? and (2) what was the overall cost of the Puerto Rico recovery plan?

- Measuring Benefits for Birdwatching in Sicily (Italy) Using a Discrete Choice Experiment; Maria De Salvo, University of Catania (Italy), Department of Agriculture
  - Measuring non-market recreational benefits delivered by ecosystems provides useful information to promote Benefit-Cost Analysis in the conservation and management of natural capital. Despite birdwatching is an increasingly recreation activity worldwide, the existing published literature on the economic benefits accruing to birdwatchers is still relatively rare, especially if compared to other wildlife-bade recreation activities (i.e. hunting, fishing), and geographically unbalanced, as mostly it deals with North-America. This paper contributes to fill this empirical gap by reporting on a primary valuation study aimed at estimating birder’s marginal Willingness To Pay (WTP) for hypothetical changes in relevant attributes of natural sites suitable for birdwatching. Data were collected by on line surveying a sample of birders living in Sicily (Italy). We used a Discrete Choice Experiment (DCE) based on four attributes: i) the probability of observe a new species; ii) the probability of observe a rare species; iii) the probability of observe as many bird species as possible during the same trip; and iv) the distance that should be travelled to reach the site. Regarding levels of attribute, the probability of observe a new species and a rare species assumed two levels, low (< 50%) or high (≥ 50%); the probability of observe as many bird species as possible during the same trip supposed three levels, low (< 15 bird species), medium (15 ÷ 40 bird species) or high (> 40 bird species); the distance that should be travelled to reach the site ranged among four levels (50 km, 100 km, 150 km, and 200 km). Choice sets were generated by adopting a D-efficient fractional design. Respondents were blocked into six blocks. Each choice set included two alternatives, and the opt-out option. Econometric analysis of DCE data was based on Mixed Logit (MXL) model which allows preferences heterogeneity and correlation among attributes. Marginal WTP were estimated with 'utility space' and 'willingness to pay space' approaches. Results suggest that, on average, a high probability of observe a new or a rare species, and an increase in the probability of observe as many bird species as possible during the same trip, positively affect the birders' utility, both in utility and WTP space. MXL model estimated in WTP space is able to better catch preferences' heterogeneity than the corresponding model estimated in utility space, and seems to also produce more reasonable welfare measures.

- Stated Preferences from Kenya and Ghana, to inform Benefit-Cost Analysis of Charity Interventions, Alice Redfern, Idinsight, Sindy-Li, Idinsight

5:30 pm – 7:30 pm   Networking Reception
DAY 2 | Tuesday, March 17
8:00 am – 9:00 am  Registration and Breakfast

9:00 am – 10:30 am  Session 5

5.A Roundtable Discussion: Recent Developments in the Market for Vaping Products and the Implications for Benefit-Cost Analysis
Since the introduction of electronic cigarettes around 2007, vaping e-cigarettes has become increasingly popular in the U.S. From the outset, the implications for public health have been controversial. E-cigarettes provide users with the addictive chemical nicotine but without exposing them to the harmful combustion-generated toxicants in cigarette smoke. On the one hand, because smoking combustible cigarettes is estimated to lead to over 400,000 deaths each year, e-cigarettes have great potential as a harm reduction strategy. In particular, evidence from randomized clinical trials suggests that vaping e-cigarettes helps adult smokers quit. On the other hand, the growing popularity of vaping among adolescents raises concerns about nicotine addiction and the possibility that vaping might serve as a gateway into smoking. Recent developments make the tradeoffs even more stark. In August 2019 reports began to emerge of lung injury associated with e-cigarette products. As of September 24 2019 the CDC reported 805 confirmed and probable cases of vaping-related lung injury and 12 deaths. In addition to responding to the immediate crisis, there is renewed interest at the Federal, state, and local levels in regulatory policies to reduce adolescent vaping. Some cities and New York State have already banned flavored e-cigarettes, which have been especially popular among adolescents.
Chair: Donald Kenkel, Council of Economic Advisors; Cornell University
Panel:
- Hua Wang, Cornell University
- W. Kip Viscusi, Vanderbilt University
- Michael Pesko, Georgia State University
- Ayda Yurekli, Foundation for a Smoke Free World

5.B Looking Backwards, Looking Inwards
Chair: Laura Taylor, Georgia Institute of Technology
Presentations:
- Is the Replacement of the Clean Power Plan by the Affordable Clean Energy Rule Justified Under Cost-Benefit Analysis?; Carolina Arlota, University of Oklahoma: College of Law
  - On June 19, 2019, the Environmental Protection Agency-EPA issued its final Affordable Clean Energy (ACE) rule. This rule repeals and replaces the Clean Power Plan enacted in 2015. Most considered the Plan an overall success, including environmentalists, numerous industries, and international actors. Such Plan was the main regulation securing the U.S. nationally determined contribution under the Paris Agreement on climate change and aimed at curbing carbon dioxide emissions from power plants and other high carbon-emitters. Nonetheless, coal, oil, and natural gas producing states sued in 2015, delaying its implementation. After the 2019 ACE rule’s enactment
repealing such Plan, strong criticism stemmed. Lawsuits from twenty-two environment-
concerned states and cities against the ACE rule ensued. In light of this controversy, this 
article investigates the costs and benefits associated with the repeal and replacement 
of the Clean Power Plan implemented by the ACE rule. This article argues that the 
deregulation pursued in the ACE rule is not justified based on three different accounts 
of cost-benefit analysis (CBA). First, it evaluates the manner in which the ACE rule was 
enacted, namely, its procedural terms. It focuses on the rule’s justifications for 
nationally deregulating carbon emissions through the repeal of the Clean Power Plan, 
despite EPA’s previous findings supporting such Plan. The article contends that the ACE 
rule contributes to uncertainty, increases litigation, and ultimately creates a non-
uniform energy policy. Second, the article discusses the substantive effects of the ACE 
rule, i.e., its merits. It assesses the costs and benefits of the ACE rule, analyzing 
quantitative and qualitative data. The interests of the involved parties, the structure and 
stringency of the ACE rule, and the lack of targets are considered. It finds that carbon 
dioxide emissions are likely to increase due to the absence of the following repealed 
measures: carbon capture, pricing carbon dioxide, and incentives for switching to 
cleaner energy sources. Third, this article considers the ACE rule based on CBA informed 
by moral considerations. The research conducted is timely because it targets a currently 
controversial topic that is subject to intense scrutiny and litigation. The research 
developed may influence such litigation, providing novel arguments against the ACE 
rule. Similarly, the findings of this research may be relevant for future policy 
assessments regarding deregulation and climate change. This is particularly important 
due to the significant increase of U.S. carbon dioxide emissions in 2018. From a 
theoretical perspective, this article fills a void in current literature, because to date no 
studies on the CBA of the repeal and proposed replacement of the Clean Power Plan 
have been published. In addition, this article addresses a contemporary example of a 
public policy enacted without the normative use of economics, one that also 
disregarded CBA as a methodological tool for maximizing overall well-being. This article 
advances a trending topic concerning CBA, namely, the incorporation of moral 
considerations into such analysis. In light of all the arguments above, this article 
concludes that the ACE rule is not justified by the results of the encompassing cost-
benefit analysis developed.

- A Retrospective Review of Retrospective Cost Analyses; Elizabeth Kopits, United States 
  Environmental Protection Agency, Art Fraas, Resources for the Future, Ann Wolverton, United 
  States Environmental Protection Agency
  o In general, benefit-cost analysis of U.S. federal regulations is conducted ex ante â€“ ‘the 
    point when we know the least, precisely because the regulations are untested.’[1] Yet it 
    is only through retrospective review of regulations that agencies can gain insights about 
    the realized costs and benefits of actions that may then lead to the elimination, 
    modification, or strengthening of regulations. Every administration since President 
    Carter has initiated efforts urging agencies to reassess existing regulations. Agencies 
    also are directed to conduct periodic reviews of regulations under some statutes.
However, these reviews rarely involve ex-post benefit-cost analysis of the original regulation, and for the most part, retrospective analysis has not become institutionalized practice. Proposals to address this gap through new legislation or other policy levers have continued in recent years. This paper reviews evidence from 26 peer-reviewed studies of the realized costs of 13 major EPA regulations to develop lessons for the design of future ex-ante and ex-post regulatory analyses. We begin by categorizing studies on the basis of methodological rigor, breadth, and whether it makes explicit comparison to ex-ante analysis. To support our review, we develop a framework for assessing the extent to which these studies provide insights on adopted compliance strategies and the resulting effect of these regulations on prices, unit costs, and total cost. We find that many of the studies provide insights on realized compliance strategies. Some also offer insights into specific elements of per unit compliance costs (e.g., capital expenditures for a subset of entities). Only a few shed light on overall per unit compliance costs and even fewer speak to the total cost of the regulation studied. All studies have data limitations, but in general more insights can be gleaned for regulations affecting industries that are required to report detailed facility-level data (e.g., power plants). In spite of data and methodological limitations as well as the narrowness of scope of some studies, we are able to identify several common sources of differences between ex-ante and ex-post estimates. For example, for 9 of 13 regulations studies show that ex-ante analysis failed to account for significant exogenous factors in the baseline. We also find evidence that substantially different compliance strategies were adopted than anticipated for 9 of 13 regulations. In some cases, the study findings suggest the direction of difference — i.e., whether per unit costs were over- or underestimated. To improve future ex-ante cost analyses, we recommend better characterization of baseline conditions, sensitivity analysis of highly uncertain parameters, greater use of economic models of the regulated sector to better reflect firm decision making, and analysis of phase-in periods. For ex-post analyses, we recommend developing plans for future study at the time the regulation is adopted. Without a plan in place ex ante that identifies study endpoints of interest, methods, and data needs, it will be difficult to conduct thorough retrospective evaluations aside from opportunistic cases. Michael Greenstone, testimony to U.S. Congress Joint Economic Committee, June 26, 2013.

- CPP vs. ACE: Economics or Ethics; Timothy Brennan, University of Maryland – Baltimore County
  - One of the major overtures of the EPA since the last election was to replace the previous administration’s ‘Clean Power Plan’ (CPP) with its ‘Affordable Clean Energy’ (ACE) proposal. The core difference between the two is not that the latter rejected climate science and integrated assessment models. Rather, the divergence arose from differences in the calculation of the social cost of carbon. These differences are based on standing (of those outside the US) and discount rates for future benefits, two classic issues in benefit-cost analysis. The question posed is whether the choice is a matter of economics or requires an ethical commitment. The standard if not universally accepted criterion for whether an ethical commitment is necessary is the hypothetical
compensation test. With regard to foreign standing, bilateral agreements could incorporate such compensation, but multilateral settings, like climate change, entail a moral commitment, albeit normatively defensible, to recognize costs to outsiders. Compensation is metaphysically impossible for sacrifices made on behalf of distant generations because future goods and services cannot be sent back to the present through a time machine. When distant generational effects are at stake, discount rates have two separate meanings: a statement about ethical obligations toward future generations, and the opportunity cost of climate investments when other investments could be made on their behalf. The conclusion is that the choice between the CPP and ACE rests primarily on ethical commitments rather than economic inferences. Economics still informs not just the future costs of climate change but what discount rate best measures the opportunity cost of climate investments.

- Institutional Roles and Goals for Retrospective Review, Jonathan Wiener, *Duke University School of Law*

5.C Moving Applications: Benefits and Costs in the Transportation Sector
Chair/Discussant: Christopher Eshleman, *Port Authority of New York and New Jersey (tentative)*
Presentations:
- The Institutional Dimension of BCA in the Transport Sector; Matteo Pedralli, *Centre for Industrial Studies*
  - Despite extensive convergence on the methodology to carry out BCA in the transport sector, the actual performance of large transport infrastructures frequently differs from ex-ante forecasts. Among the possible reasons for this discrepancy there are technical and institutional ones. On the one hand, technical reasons point to an imprecise identification of the effects generated by the project, or to a difficulty to include certain effects in the analysis. On the other hand, institutional ones include the role of BCA in decision making, strategic misrepresentations by project promoters, absence of incentives for the private and public sector to avoid optimism bias and reveal true information about the project, competing interests, difficult communication of BCA results, path dependency. Against this background, this presentation explores how the institutional setting of BCA can mitigate or exacerbate the disruptive interplay of self-interest maximising actors, with specific reference to the transport sector. It illustrates a conceptual framework for the analysis of transport project appraisal systems, which elaborates on the World Bank's model for assessing Public Investment Management, on relevant literature and on good practices of BCA embeddedness in institutional settings from different countries and international organisations. A sound decision-making process relies not only on solid analysis, but also on clearly communicated appraisal results. For this reason, the presentation examines elements such as the appraisal's publicity (which can be broken down into the use of appraisal reports during the decisional phase in order to engage stakeholders on one hand and the report publication after the decision has been taken on the other hand) and the development of standard templates facilitating the understanding of BCA results. The presentation
highlights how the institutional setting affects the relevance, the performance and the use of transport project appraisals. Ultimately, it argues that embedding transport project appraisal in a formalised institutional setting is instrumental to ensuring a clearer communication of appraisal results and also more transparency in public investment decision making, reducing uncertainties stemming from biased decision-making processes. A conducive institutional setting increases solidity, objectivity and comparability of appraisal results and ensures as well, crucially, that these results actually feed into the decision-making process.

- Economics (and Emotional Support Ducks) in Aviation Consumer Protection Regulation: Benefit-Cost and Beyond; Deborah Aiken, US Department of Transportation, Stephen Brumbaugh, US Department of Transportation
  
  In this presentation, we describe potential sources of market failure in the area of aviation consumer protection, discuss the challenges of conducting benefit-cost analysis in this area, and give examples of how these issues have been addressed through government intervention. Aviation consumer issues receive considerable attention from policymakers and the traveling public. The confined space of airplane cabins can be uncomfortable and passengers may feel vulnerable once the door closes. Airline personnel must deal with an environment that can exacerbate issues manageable in other settings. A single incident can spark national media coverage and public outcry, and lead to congressional action even if it involves factors beyond an air carrier's control like extreme weather. Simultaneously, airlines are businesses with interests that may appear at time to diverge from the interests of the traveling public. Incompletely defined property rights, externalities, and information asymmetry are all potential justifications for a role for government in the air travel setting. We describe these issues within the terms of a traditional economic framework, and how to approach them from a benefit-cost perspective. Next, we present recent examples of federal intervention, including regulation of service animals traveling on aircraft, use of electronic cigarettes, and rules pertaining to excessive tarmac delays. We show how to frame these issues within an economic framework, and illustrate how benefit-cost analysis can effectively inform decision-making in the aviation consumer protection setting.

- Spatial distribution of agglomeration economies: Estimation of distance decay parameters with heterogenous areas; Ana Teresa Vargas Frutos, Imperial College London
  
  Transport systems increase the number and quality of interactions between agents and creates positive externalities via agglomeration effects. Agglomeration externalities are estimated by point elasticity methods that do not remain stable under small variation of the assumptions. Studies that tested the stability of the point elasticity parameter found non-linearity in the relationship between productivity and density when varying the area characteristics. This indicates that current appraisal methodologies fail to reflect the overall benefit of transport projects, which motivates the need for a new estimation methodology. This paper bridges this literature gap and provides an empirical estimation of agglomeration effects that accounts for area characteristics. The applied methodology aims at solving the instability of point elasticity estimates. Our empirical
analysis uses Financial Analysis Made Easy (FAME) data, which records firm-level information for British companies (expenditure, sector, employees, location) over the period 2009-2018. We match FAME data to the Office for National Statistics Postcode Directory (ONSPD) to control for geographical characteristics (size, type of area) based on the Census Area Classification. Finally, all this data is combined with NOMIS information, which provides local labour market information over the period 2004-2018. We estimate spatial parameters of agglomeration using a two-stage approach. First, we estimate firm productivities using panel data models such as System Generalised Method of Moments (Sys GMM) and Panel Control Function (CF) to address endogeneity issues arising from the unobserved firm productivity. The second stage consists of an estimation of agglomeration spatial parameters: we regress the estimated productivity measure on a vector of local area characteristics that includes the agglomeration variable (the effective density). In this second step, we use panel data models to correct for sources of endogeneity from confounders and unobserved local characteristics. We use two measures of effective density: i) parametric variable divided by distance bands and, ii) semiparametric variable weighted by distance. In addition, categorical variables are included to control for the size and the type of area, which is a novelty in the estimation of agglomeration parameters. This project contributes to the literature of transport-induced agglomeration benefits by increasing the accuracy with which agglomeration externalities are captured and predicted. Our new spatial agglomeration parameters now account for urban areas' heterogeneity. We reflect the spatial scope of agglomeration externalities by focusing on the distance decay parameter. By introducing urban areas' heterogeneity in the estimation of the distance decay parameter, we address biases currently found in the literature of transport-induced agglomeration benefits, namely downward biases for major urban areas and upward biases for smaller urban areas. We also test the performance of the econometric methods chosen by comparing our results with conventional panel data methods and estimating the agglomeration parameters applying a one-stage approach.
5.D The Value of Health
Chair: David Widawsky, U.S. Environmental Protection Agency
Presentations:

- When Dollars and DALYs Collide: Minimizing Error When Measuring Disease Burden Reduction; Ted Miller, Pacific Institute for Research & Evaluation
  
  - Disease/injury burden has both monetary components and intangible components. To report burden in a single metric or make comparisons in burden over time or across diseases/injuries, analysts often monetize disability-adjusted or quality-adjusted life years (DALYs or QALYs). This practice has serious theoretical and empirical pitfalls. This paper suggests a better alternative. It recommends combining DALY losses with resource costs for medical care, road crash damage, police, incarceration, etc., by converting the resource costs into DALY-equivalents rather than DALYs into dollars. That approach avoids the pitfalls because we can define a standardized situation to use in valuing a DALY. By definition, DALYs sum life years lost and years lived with disability. Although a year of life expectancy may vary in quality, it can be directly measured. A year lived with disability is harder to measure as it requires establishing relative values for different dimensions and severities of functional loss. Therefore, we propose using a year of life expectancy in average health as the standard DALY when computing the conversion factor for resource costs. An obvious advantage of this strategy is that an extensive literature addresses the value of reducing mortality risk (VSL). Dividing the VSL by the average years of life expectancy lost to a death would yield the value of a standard DALY. That value has the same limitation as any other DALY; it implicitly treats all years of healthy life expectancy as identical. Conversion based on a standardized DALY would provide uniform, reproducible handling across studies. Importantly it also would minimize the standard error in the resulting estimate of total harm. If we monetize DALYs, even at a low-end VSL, DALY losses account for at least two-thirds of the costs of alcohol-involved incidents, and their magnitude is more uncertain than the resource costs. Any combined harmful-use measure sums the YLD and resource cost components. Since the conversion factor has error, the error in the factor that it is multiplied by will itself be magnified by the multiplication. Thus, the net error in the aggregate estimate will be lower if the smaller and lower-variance component is converted. The paper works an illustrative example: measurement of progress toward UN Sustainable Development Goal 3.5.2, which calls for reducing harmful alcohol use by 10%.

- Cost-benefit analysis of the effects of an early childhood intervention on adult health at age 37; Judy Temple, University of Minnesota – Twin Cities
  
  - Although high quality early childhood programs have been found to improve educational attainment and reduce crime, effects on adult physical health are understudied. One study published in Science (Campbell et al. 2014) suggested that an early educational intervention offered in North Carolina in the 1970s had significant effects on prehypertension and obesity for participants at age 35. This study makes use of ongoing Chicago Longitudinal Study of the Chicago Child-Parent Center educational
intervention offered from preschool through grade 3 to assess the relationship between program participation in the 1980s and adult health outcomes. While in two previous CBAs of the Child-Parent Center intervention estimates of benefits were based mostly on predictions of adult earnings, crime, and welfare receipt (e.g., Reynolds et al. 2011a), we focus now on newly-available health outcomes for obesity, diabetes, hypertension, smoking and substance abuse. By conducting a partial benefit-cost analysis, we ask, even without including effects on earnings and reduced crime, do the health benefits to participants and society at large more than offset the costs of the early intervention? We begin by obtaining estimates of the effects of participation in the early intervention on the health outcomes listed above. The Chicago Longitudinal Study has followed a cohort of over 1,500 students who enrolled in public kindergartens in the 1980s in the poorest neighborhoods in the city. Approximately 1,000 participated in the federally-funded Title 1 intervention, while a comparison group of students enrolled in matched kindergarten sites served as the controls. Following Reynolds et al. (2011b), we use inverse propensity score weighting methods to control for both nonrandom program assignment and nonrandom attrition over time in this quasi-experimental study. Time permitting, we may include treatment effect estimates based on bounding methods. Using recent estimates in the literature regarding the costs of diabetes, reduced smoking, etc., we generate estimates of benefits from improved health for private individuals and society as a whole. Our initial estimates indicate that participation in the early education intervention is associated with reduced BMI, reduced smoking, and reduced incidence of diabetes. Our study adds to the knowledge base by providing additional evidence on the relationship between early education investments and later outcomes.

- Estimated Value of Avoiding Cancer Risks by Cancer Site and Population; Matthew LaPenta; Abt Associates Inc.
  - In this paper we estimate monetized values for achieving small reductions in the risks for many common specific types of cancer. We apply a method used to estimate values for reducing cancer risk in several recent U.S. EPA’s economic analyses to 110 different common cancer sites that are included in the Surveillance, Epidemiology, and End Results (SEER) Program data. For each cancer site we include separate estimates for 17 different populations, including all individuals, all employed individuals, children, the armed forces, and individuals employed in 13 different industry sectors. The main contribution of our paper is to provide a set estimates that can readily be used in cost-benefit analyses of regulatory and non-regulatory policies that achieve cancer risk reductions. Our estimates for the value of a cancer risk reduction have two separate components: (1) reducing the risk of dying from the cancer, and (2) reducing the risk of being diagnosed with cancer without dying from it. We use two different estimates for the willingness-to-pay (WTP) to avoid non-fatal cancer risks and use EPA’s recommended value for the value of a statistical life to estimate the value of reducing the risk of dying from cancer. We account for latency between exposure and diagnosis by assuming that the distribution for the age of the individuals diagnosed with cancer ...
that is caused by exposure is the same as the distribution of cancer incidence by age for cancer irrespective of the cause. Considering the employed populations, this is equivalent to assuming a latency period between exposure and diagnosis of about 20-25 years for most of the cancer sites we considered.

- You Can’t Get There from Here: Federal Health Benefits Analyses; Richard Williams
  - Despite the humorous reply to someone asking for directions, this may be the problem for many federal economists attempting to estimate the benefits of health rules, particularly ones with complicated science. This is not due to any particular failing of federal economists but rather that they face a nearly impossible task. Recent studies of the validity of scientific findings, most notably in nutrition, psychology and environmental health sciences, point to the difficulty. For example, the editor of the New England Journal of Medicine wrote, 'It is simply no longer possible to believe much of the clinical research that is published, or to rely on the judgment of trusted physicians or authoritative medical guidelines.' Similarly, in 2015, the Chief of The Lancet wrote, 'Much of the scientific literature, perhaps half, may simply be untrue.' This paper will discuss the numerous ways that different types of science that goes into benefits analyses can be wrong and the fact that most federal economists do not have the time, freedom, or budgets to assess the totality of the evidence. In addition, preamble summaries encapsulating the views of agency scientists are legal documents rather than objective weight of science documents.

5.E Social Program Evaluations: Results and Methods
Chair: Demetra Nightingale, Urban Institute
Discussant: David L. Weimer, University of Wisconsin, Madison
Presentations:
- The Cost-Effectiveness of Giving Budget Flexibility to Public Housing Authorities; David Long, Princeton Policy Associates
  - Public housing agencies receive their annual HUD funding through three distinct revenue streams—operating funds, capital improvement funds, and Housing Choice Voucher funds—and cannot shift money between the streams or use it for housing purposes not specifically permitted for each fund. The Moving to Work (MTW) demonstration allows participating agencies to treat these funds as fungible and also provides waivers from many federal rules. The study to be described sought to isolate the role play by MTW budget flexibility per se by comparing the experience of 10 agencies that used the flexibility most intensively to that of the other 29 participating agencies. Thus, rather than estimating the aggregate impacts of MTW participation on cost and housing outcomes, it determined the difference in outcomes associated with increased budget flexibility and the choice by agencies to use it aggressively. The results of the study indicated that the 10 housing authorities that used budget flexibility most intensively reduced the per-household cost of delivering housing assistance and increased their use of non-traditional housing assistance and support services compared to the other agencies. Thus, budget flexibility enabled agencies to change their housing programs in innovative and cost-effective ways.
• Benefit Cost Analysis of Affordable Housing Programs in New York City; Kenneth Acks, NYU Schack RE Cost-Benefit GR, LLC & Env Valuation & CB News
  o In 2016, nearly 1/2 of renters were cost-burdened (spending >30% of income on rent), up from 20% in 1960; and 11 million, or 10% spend more than half their paychecks on rent. The NAHB/Wells Housing Oppty Index peaked in 2012 when 78% of new and existing home sales were affordable for a typical family but fell to 56% and is projected to fall below 50% in 2019. Between 1990 and 2017, units under $600 (inflation-adjusted) per month fell by nearly 4.0 million, bringing down the share of these low-cost units from 46% of the stock in 1990 to 25%. Using a spatial equilibrium model applied to 220 metro areas Hsieh and Moretti (2019) find that misallocation of labor due to stringent new housing supply restrictions limited the number of workers with access to high productivity cities lowering growth 36% from 1964 to 2009. GDP and average wages could have been 8.9% and $8,775 higher respectively in 2009, a total of $1.27 trillion. In NYC despite Mayor de Blasio’s push to increase affordable housing, the percentage of new units affordable to people earning 80% of the area median was 40.5% in 2016, down from 64.4% in 2000. At the same time, median rents went up by $300 since 2000, while the median income of a renter household increased $145 per month. The Urban Institute set forth 4 sets of solutions 1) Produce more housing at lower cost via reform of land use laws and building codes and accelerating innovation in design and construction and other means; 2) Preserve unsubsidized affordable housing and protect against displacement; 3) Expand assistance for low income households via direct income supports or housing assistance; 4) Expand access to homeownership - including new forms of ownership, creating and expanding lending products, and applying technology and new data to expand credit access. NY and California have both also increased restrictions upon allowable rent increases, which economists generally fear cuts supply. In NYC government has built and preserved hundreds of thousands of units in the past 50 years. Mayor de Blasio’s originally instituted a plan to build and preserve 200,000 rent-regulated homes over 10 years. This rose to 300,000 over 12 years at twice the cost - $13.5 billion in city subsidy alone. This presentation will present rough estimates of costs and benefits of affordable housing in NYC and include application of distributional considerations particularly, distributional weights set forth by Adler (2016). The Cost-Benefit equation has recently been expanded by new results regarding the effects of housing upon health and achievement. The general analysis will broadly parameterize alternative policy CBs and then the focus upon two most likely to produce the greatest bangs for the buck: 1) reducing zoning and code restrictiveness and 2) income supports. Relative novelty results from application of Affordable Housing BC measures which are rare, the distributional weights, inclusion of health achievement and other benefits, measures of zoning restrictiveness, and possibly micro level prop tech based real estate and demographic.

• The Importance of Covariation in Monte Carlo Analysis: An Illustration from the BOND Benefit-Cost Study; Daniel Gubits, ABT Associates
  o The findings from most benefit-cost analyses (BCA) are subject to considerable uncertainty. In BCAs of social programs, much of this uncertainty emulates from sampling error to which the impact estimates used in determining benefits and costs are subject. Weimer and Vining* and others strongly suggest that uncertainty in BCAs of social policies be addressed by Monte Carlo analysis. In the Monte Carlo approach, point estimates of impacts about which there is uncertainty due to sampling variability are replaced by random draws from an appropriate range implied by the standard errors of
the impact estimates. This is typically done thousands of times in order to generate thousands of sets of estimates of benefits and costs. Total net benefits can then be computed by summing the benefits and costs from each set. The confidence interval around the mean total net benefit amount will indicate the uncertainty of the net benefit estimate—for example, whether it includes both positive and negative values. A potential issue with this procedure is that the individual impact estimates may be correlated. For example, if a government program has a positive impact on earnings, this may be accompanied by a negative effect on the receipt of government benefits. Thus, in principle, the potential correlation among impacts should be explicitly treated in Monte Carlo studies—for example, by drawing from a joint distribution of parameters. This is often not done, however, in part because it may be difficult to do so. For example, different impacts may be estimated with different data sources. Because it is often not done, it is useful to investigate how important it is to take account of covariation among impact estimates in conducting Monte Carlo analyses. To do this, we conduct two Monte Carlo analyses of CBAs. In the first, we ignore any covariation between the impacts and in the second we take full account of the covariation. We then compare results to see how much difference taking full account of covariation makes. We do this twice. First, we conduct a simple Monte Carlo analysis of simulated data containing only two impact estimates that are highly correlated. The simulated data are constructed to illustrate how taking account of covariation can make an important difference in results. Second, we look at a recent Monte Carlo analysis of a complex BCA from the Benefit Offset National Demonstration (BOND), a large social experiment conducted by the Social Security Administration. In the BOND Monte Carlo, covariation among nine impact estimates was taken in account. We show the extent to which taking account of covariation affected the BOND BCA results.

10:30 am – 10:45 am  Break

10:45 am – 12:15 pm  Session 6

6.A Health Valuation of Mortality
Chair: Jennifer Baxter, Industrial Economics, Inc.
Discussant: W. Kip Viscusi, Vanderbilt University
Presentations:
- Value per Statistical Life Year (VSLY) and its Dependence on the Time Path of Risk Reduction: Stated-Preference Estimates; James. K. Hammitt, Harvard University (Center for Risk Analysis) and Toulouse School of Economics (University of Toulouse)
- Risk perception, learning, and parents’ willingness to pay to reduce heart disease risks; Mark Dickie, Department of Economics, University of Central Florida
- Does the Value per Statistical Life Vary with Age or Baseline Health? Evidence from a compensating wage study in France; Daniel Herrera-Araujo, Université Paris-Dauphine
Earth Observation (EO) is a highly strategic space sector which enables a wide array of services and applications for governments, firms and citizens. Over the past several decades, an increasing amount of satellite data has become available, boosting the amount of information that can be used to support decisionmaking. Today, around 500 EO satellites orbiting the Earth allow users to observe a variety of natural and socio-economic phenomena that would be very difficult and costly to monitor from the ground with the same optimal coverage, accuracy and consistency. These phenomena include global societal challenges such as climate change and air pollution, as well as local issues such as precision farming, urbanisation and transport infrastructures monitoring. As a result, investments in EO have the potential to generate significant socio-economic benefits. However, these magnitude of these benefits is difficult to estimate quantitatively, and as of today, economists and the space sector have not identified a common methodology to accurately quantify the socioeconomic benefits derived from the use of EO data.

The aim of this special session is to stimulate a meaningful discussion on the current and potential socio-economic benefits of EO as well as appropriate methodologies, including Benefit-Cost Analysis, to capture and measure these benefits.

In this special session, each participant is invited to bring his/her own experience in the analysis of the benefits of Earth Observation and stimulate a debate in which the challenge of quantifying the socioeconomic benefits of EO is analysed from different perspectives.

The first paper presented by Massimo Florio (University of Milan) aims at evaluating the impact of Earth Observation on academic research by attempting to elaborate a method useful to monetise the value of academic publications.

The second paper presented by Valentina Morretta (University of Milan) aims at reviewing all the methodological approaches used in the space sector grey literature while proposing a Cost-Benefit Analysis approach following the framework used to evaluate the benefits of large Research Infrastructures.

The third paper, presented by Bethany Mabee (RFF and VALUABLES), will introduce the framework and microeconomic tools used by researchers affiliated with the VALUABLES Consortium and describe some of the challenges associated with interdisciplinary collaborations between economists and Earth scientists that attempt to quantify the socioeconomic benefits of EO.

The fourth paper, presented by Yusuke Kuwayama (RFF and VALUABLES), will summarize the results of several impact assessments conducted by the VALUABLES Consortium. He will present quantitative estimates of the benefits of using satellite data in decisionmaking, including air quality regulation, post-wildfire response, endangered species conservation, and management of harmful algal blooms.

Chair: Massimo Florio, *Department of Economics, Management, Quantitative Methods, Università degli Studi di Milano*

Discussant: Carl D. Shapiro, *United States Geological Survey*

Panel:

- **Using Microeconomics to Measure the Societal Benefits of Earth Observations**; Bethany Mabee, *Resources for the Future*
- **The Socio-Economic Benefits of Earth Observation: Measurement Methods and Challenges Ahead**; Valentina Morretta, *Department of Economics, Management, Quantitative Methods, Università Degli Studi di Milano*
- **The Societal Benefits of Earth Observations: Impact Assessment Results**; Yusuke Kuwayama, *Resources for the Future*
• Estimating the impact of earth observation on academic research production: a cost-benefit analysis approach; Massimo Florio, Department of Economics, Management, Quantitative Methods, Università Degli Studi di Milano

6.C BCA of Cars, Dirt, and Chemicals
Chair: John Powers, Public Company Accounting Oversight Board (PCAOB)
Presentations:

• Potential Air Quality Benefit per Truck Estimates of a Future Reduction in the NOx Emissions from New HDOH Vehicles; Bharat Ramkrishnan, NERA Economic Consulting
  o Both the U.S Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) are in the process of considering a possible tightening of the current NOx emissions standards for heavy-duty-on-highway (HDOH) vehicles. In this paper we describe and apply an approach to estimate the benefits-per-truck associated with a potential future 50% reduction in in-use NOx emissions from new HDOH vehicles. The benefits we include in our estimates are from reduced mortality risks of ambient ozone and fine particulate matter (PM2.5) concentration decreases predicted as a consequence of the lower HDOH truck NOx emissions that could be expected from tighter tailpipe emissions standards. This paper also illustrates the sensitivity of the benefits-per-truck estimates to geographical location and to alternative assumptions about the continued existence of the mortality risk relationships at ambient pollutant levels that are below the ozone and PM2.5 National Ambient Air Quality Standards (NAAQS). The estimates provided indicate an upper bound on the maximum per-truck compliance cost that could be justified under a benefit-cost analysis of tighter federal standards.

• Do the Benefits of Mandatory Vehicle Inspection and Maintenance Under the Drive Clean Program in Ontario Outweigh the Cost? Rakhal Sarker, University of Guelph
  o Emissions from automobiles are an important contributor to local and regional environmental problems such as smog, respiratory and other health issues and climate change. To address these environmental problems, Ontario introduced a mandatory inspection and maintenance program called 'Drive Clean' for Light and Heavy-Duty vehicles in 1999. All Light-Duty vehicles require emissions testing every two years under this program. Relevant emissions data collected at registered Drive Clean facilities are automatically uploaded to a central database called the Drive Clean Vehicle Emission Transaction System accessible by the Ministry of Environment and the Ministry of Transportation in Ontario. How effective is the mandatory vehicle inspection and maintenance program to reduce emissions of carbon monoxide, Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs) and improve air quality in and around urban areas? The results from published studies in the United States fail to provide a clear positive answer to this question (Calvert et al., 1993; Beaton et al., 1995; Pokharel et al., 2003; and, Zhang et al., 1996). Such environmental programs are relatively new in Ontario. Based on a simulation analysis of emissions data collected through the Drive Clean program in Ontario, Livernois and Moghadam (2005) argue that the Drive Clean
program in Ontario should target vehicles 8 years and older as 93 to 96 percent of emissions reductions come from these vehicles. Thus, they conclude that the Drive Clean program would be more cost-effective, if the policy would target vehicles 8 years and older rather than testing all vehicles 3 years and older. While these results are interesting and informative, they do not reveal any measure of the benefits of the Drive Clean program to Ontarians. Similarly, the full costs of the program are also not estimated. The purpose of this paper is to bridge this gap by identifying all relevant costs and benefits, classifying them as primary, secondary and technological benefits and costs and determining if the benefits of the Drive Clean program in Ontario outweigh the costs. We believe that the results of this research will be informative and useful for future environmental policies or programs in Canada. We also hope that this paper will initiate active discussion and thoughtful engagements among the participants at this conference.

- Confounding in Long-Term Epidemiological Studies of Particulate Matter: Implications for Estimated Benefits; Garrett Glasgow, NERA Economic Consulting
  - The benefits in regulatory impact analyses (RIAs) for the NAAQS for particulate matter are primarily based on inferences from cohort epidemiology studies that estimate associations between mortality (or other disease) rates and ambient PM2.5 levels over time. However, these cross-sectional studies are vulnerable to confounding due to differences across the community populations that may be correlated with PM2.5 exposure, such as socioeconomic factors. Further, these cross-sectional studies cannot address the influence of long-term time trends in both ambient PM2.5 concentrations and mortality. Recently, several studies have examined the possibility of unmeasured confounding of the long-term association between PM2.5 exposure and mortality by decomposing PM2.5 into two orthogonal components: 'a 'global' component that measures the national trend in pollution, and a 'local' component that measures the local trend in pollution after controlling for the national trend. Assuming that the relationship between PM2.5 exposure and mortality is linear, the coefficients on the global and local measures of PM2.5 should be similar. However, while these studies found the coefficients on the global PM2.5 trend in their models to be positive and statistically significant, the coefficients on the local PM2.5 trend were smaller than those on the global trend and statistically insignificant. That is, these 'PM decomposition' studies find that while PM2.5 and mortality are trending downward over time at the national level, areas with steeper declines in PM2.5 do not have correspondingly steep declines in mortality. This raises the concern that the long-term relationship between PM2.5 and mortality is confounded by some other, unmeasured, long-term trends, and may even be spurious. Several researchers have proposed various explanations for how there could be a non-spurious relationship between PM2.5 and mortality, yet the estimates of the global and local coefficients in these PM decomposition models might diverge. In this paper we use a simulation-based approach to test a number of these explanations. We find that unmeasured confounding and some types of measurement error can explain these findings, while other proposed
explanations (such as nonlinear concentration-response functions and PM effects that take several years to emerge) do not. We conclude by discussing the implications of our results for understanding of the estimated benefits attributed to reductions in ambient PM2.5 levels.

  - Agencies use VSL to value avoiding cancer. Estimation is more complicated for other endpoints. In cancer risk assessment, risk is estimated by multiplying exposure reduction by a precautionary unit risk factor that typically assumes associations are causal. This model is known (and intended) to systematically overstate risks and benefits. In addition, intermediate endpoints on the cancer pathway are treated indistinguishably from cancer, thus erasing toxicological uncertainty and imposing other forms of bias. This paper proposes a new approach based on economics rather than biology. It recognizes that an 'adverse effect' is any phenomenon that people are willing to pay to avoid. Thus, benefits would be estimated directly from toxicologists' knowledge using stated preference methods. WTPs would be estimated for multiple intermediate endpoints ordinarily aligned on the cancer pathway, with monotonically increasing WTPs expected. These WTPs would be normalized to conform to non-experts' preferences. This method has obvious advantages. First, it uses all the available information, which current methods don't do. Second, it accounts for uncertainty better than weight-of-evidence methods, which lack transparency, reproducibility, and/or objectivity. Third, it captures toxicologists' professional judgments in a manner consistent with benefits estimation. Fourth, it respects the distinctive roles of toxicologists, economists, and nonexperts, substantially reducing opportunities for expert opinions to supersede individual values. Fifth, it would enable regulators to derive plausibly objective benefit estimates for reducing the incidence of intermediate endpoints. Sixth, it would permit rapid updating when new information becomes available, such as changes in toxicologists' professional judgment about the risks posed by intermediate endpoints. Similar methods could be devised for estimating the value of preventing intermediate endpoints on pathways to non-cancer health effects.

6.D Data and Securities Market Security

Chair/Discussant: Connor Raso, *Securities and Exchange Commission & Georgetown Law*

Presentations:

- **A Dynamic Economic Evaluation of Cyber Security Investment; Kerry Krutilla, O’Neill School, Indiana University – Bloomington**

Cybersecurity is often addressed as a technical problem. However, private and public decision-makers need to know how much investment is efficient to reduce cyber system vulnerabilities, compared to investments in other organizational objectives. Stimulated by the 'Gorden and Loeb' (GL) model, an early influential contribution, a sizable literature has emerged that studies this question. The economic evaluation literature based on the GL framework uses one-period assessments, and assumes that the link between investments in cybersecurity and resulting cybersecurity protection has a constant returns-
to-scale relationship. The contribution of our research is to extend the evaluation framework to consider intertemporal effects and different efficiencies of investment to improve cyber system security. Using this approach, cybersecurity in the current period depends on the accumulated cybersecurity infrastructure resulting from past decisions, while investments in the current period are needed to maintain and upgrade this system. The discount rate, the rate at which the cybersecurity system depreciates, and the efficiency of investment are key parameters in determining the level of current period investment in cybersecurity systems that maximizes benefits over costs. The results in GL literature turn out to be the special case when cybersecurity infrastructure fully depreciates each period, and the rate of discount is zero. In the more general and realistic cases, the economically efficient level of cybersecurity investment tends to be lower than that found in the GL literature. We provide some practical recommendations for the boundary levels for efficient cybersecurity investment based on an organization's discount rate, knowledge that decision-makers have about the rate of depreciation of their cybersecurity systems, and the impact of investment in reducing system vulnerabilities. Our study helps bridge the gap between theoretical work in the literature on the economic efficiency of cybersecurity investment and its practical application in firms and government agencies.

- Estimating the Costs and Benefits of a Federal Privacy Law; William Rinehart, American Action Forum
  - At the end of January 2020, the California Consumer Privacy Act (CCPA) will take effect and become the first comprehensive privacy law in the United States. The legislation is a significant shift in privacy law in the United State. Since the measure grants regulators a significant new source of authority over information processors, firms will soon be forced to adhere to a new kind of compliance regime. Firms of every size in nearly every industry are preparing. Because of this new law, the focus has shifted to federal lawmakers, which have taken to writing a federally applicable privacy law. Unknown within this process are the costs and benefits of the CCPA and a similar federal bill. This paper will aim to estimate both, a first of its kind. Fours kinds of costs will soon be borne by firms due to the CCPA. First, the regulation forces firms to retool data processes to realign with the new demands. These are generally one-time fixed costs. Here, startups maintain a benefit as it is easy to change code or data processes before they are expansive. Established firms will have to refactor their processes. Second, the regime adds risk compliance costs, causing companies to staff up to ensure they are abiding by regulation. These should be considered variable costs that largely grow with the company. Third, firms that improperly disclose information or otherwise violate the statute will suffer fines, which are typically tied the number of disclosures. Finally, the law will change the investment dynamics for all those affected industries. European regulators recently implemented their own comprehensive privacy law, known as the General Data Protection Regulation (GDPR). The move has been studied by economists, market participants, and trade associations. By compiling these source, the paper will estimate the total impact of a U.S.-based privacy law, modeled after the CCPA. To appraise the potential benefits of a federal privacy law, an online survey to estimate the willingness to pay will be deployed. In combing both elements, this document will serve as a comprehensive resource for federal rulemakers in their effort to understand the fiscal impact of a federal privacy law.

- Weighing Costs and Benefits in EU administrative practice: the case of European Securities and Markets Authority; Letizia Gianni, European University Institute
In the continuous quest for new means to legitimize the ever-growing power shift towards EU agencies, the consideration of costs and benefits of proposed regulation may deserve further attention. Indeed, on the basis of the regulations establishing the European Supervisory Authorities (ESAs), ESAs are under a legal obligation to carry out ‘if considered appropriate and not disproportionate’ a formal Cost-Benefit Analysis (CBA) when drafting regulatory or implementing technical standards (RTSs and ITSs), as well as in issuing guidelines and recommendations. In this paper, I assess how this legal mandate has been performed so far, focusing in particular on the draft RTSs elaborated by the European Securities and Markets Authority (ESMA), in order to establish whether ESMA’s administrative practice is giving rise to a European version of CBA and, if so, to identify its distinct features. The question also arises of whether (and how) CBA may be designed to supplement other ways in which agency legitimacy is being enhanced.

Section I of the paper offers a very brief overview of the basic features of mainstream CBA according to the international literature, in order to outline which are the fundamental stages of this kind of economic analysis of law. Section II describes the results of a case study that I developed by evaluating, according to the parameters identified in Section I, the CBA annexed to the draft RTSs proposed by ESMA and finally adopted by the Commission. The findings of the case study are commented on in Section III, where it is observed that ESMA’s administrative practice is laying the foundations for an EU notion of CBA, which is distinct from the international benchmark. The conclusions cast some doubt over the potential of the EU notion of CBA to bring greater advantages in terms of agency accountability and procedural transparency, also taking into account the broader context of the EU institutional architecture.
6.E Deregulation and Judicial Review
Chair: Eliane Catilina, U.S. Environmental Protection Agency
Discussant: Bethany Davis Noll, NYU School of Law - Institute for Policy Integrity

Presentations:
- Benefit-Cost Analysis of Judicial Review of Regulation; Kyle Rozema, Washington University in St. Louis

Political ideology is thought to be a main determinant of judicial decision making (e.g., Sunstein et al., 2006). Given the close link between ideology and decision making, it is perhaps unsurprising that political ideology is also thought to be a main factor used in judicial appointments (e.g., Bonica and Sen, 2017). One area in which the role of ideology in judicial appointments and judicial decision making can be important is regulatory policy. Congress enacts statutes, which are then implemented by federal agencies through a rule-making process. However, agencies do not always have the final word when it promulgates a rule. Despite judicial deference to agency discretion under the Chevron doctrine, judicial review often determines the final outcome of a rule. Miles and Sunstein (2006) analyze judicial review of regulatory actions by the Environmental Protection Agency and the National Labor Relations Board from 1990 to 2004. They find evidence of a strong influence of judges' political convictions in judicial review of agency interpretations of law. Subsequent legal scholarship and political science research support and extend this evidence. The goal of this project is to estimate the expected impact of judicial appointments on the benefits and costs from federal regulation. We use the results of agencies' benefit-cost analyses, which are required in some settings by several executive orders, to calculate the benefits and costs of judicial regulatory review. We combine estimates of the benefits and costs of reviewed regulatory and deregulatory actions with estimates of the influence of judges' political convictions on review outcomes. In this way, we estimate the statistical expectation of the regulatory benefits and costs that flow from the appointment of a judge with conservative versus liberal convictions.

- Analysis of U.S. De-Regulatory Actions; Douglas Scheffler

Deregulation has been an important goal of the Trump Administration since it began. In its Web site the Office of Management and Budget (OMB) states that total savings from de-regulatory actions total $24 billion and lists them by Department. However, there is no further analysis or break-out of these actions. My preliminary research indicates that a significant number of these actions deal with reducing or eliminating specified record-keeping requirements and the benefits are the monetized value of the time saved. In the presentation I will show my completed analysis of the FY 2019 de-regulatory actions, including a taxonomy, and sub-totals of monetized benefits for each class in the taxonomy, I will also discuss the impact of each type of benefit. For example, while reduced record-keeping times may not effect a company's bottom line, this still may have an operational impact.


12:15 pm – 2:00 pm Luncheon and Keynote Address


2:00 pm – 3:30 pm Session 7
7.A Dodging Bullets and Bombs
Chair: Glenn Blomquist, University of Kentucky
Discussant: Kyle Rozema, Washington University in St. Louis
Presentations:

- **Deterring Police Shootings; W. Kip Viscusi, Vanderbilt University**
  This article proposes using the value of a statistical life (VSL) to establish efficient levels of deterrence for wrongful deaths resulting from police shootings. Except in rare, highly publicized instances, the level of compensation falls far short of any meaningful deterrence value. This paper provides a detailed summary of settlements and court awards for police shootings, which are compared to average wrongful death awards and jury verdicts in wrongful death cases. In circumstances where deterrence is a paramount concern, the VSL should establish the appropriate level of compensation level. Some of these situations would meet standard criteria for the award of punitive damages. Setting damages based on the VSL will incentivize municipalities to internalize the costs of such shootings in a manner similar to that achieved through an explicit benefit-cost analysis. More typically, the VSL does not correspond to the appropriate level of damages awards since it will provide excessive levels of insurance, as is the case with hedonic damages generally. Nevertheless, the VSL can serve as a measure of the cost of such shootings and be incorporated in benefit-cost analyses to assess the desirability of different measures to reduce police shootings. Previous studies have not embraced the benefit-cost approach because of the purported difficulty of monetizing the mortality risks, but the use of the VSL solves this problem. The paper provides estimates of the total mortality cost from police shootings and calculates the level of these costs based on different gradations of police culpability.

- **Benefit Analysis of the 1994 Assault Weapons Ban; James Oehmke, Northwestern University**
  As of September 30 there were 7 mass shootings in the U.S. in which 4 or more people were killed. 2019 is on track to be the deadliest year ever in the U.S. in terms of the number of mass shootings and the number killed in these shootings. Policy proposals to curb mass shootings and resulting casualties run from renovating schools, to arming teachers to myriad forms of gun control. However, in recent history only one policy has been put in place with the intention of directly reducing the number of people killed in mass shootings: the Violent Crime Control and Law Enforcement Act of 1994 included an assault weapons ban (AWB). The AWB had a ten year sunset clause and was not renewed, going out of existence in 2004. This paper analyzes the effect of the AWB and quantifies the value of the lives saved from the ban. It also projects the number of lives that could have been saved had the AWB remained in place from 2004 through the end of 2019, and the value of these lives. The critical issue is that there only 10 years of data during which the AWB was in place. This paper addresses the issue with benefits from two insights. First, the number of people killed in mass shootings can be modeled as a dynamic process. Second, the paper recognizes that the periods from 1982 (the first mass shooting) to 1994, from 1995 to 2004 when the AWB was in place, and the period from 2005 to now, were three separate regimes in which this dynamic process functioned. Putting these insights together enables treatment of the regimes as panels, allowing application of the Bond-Blundell estimator using the generalized method of moments (GMM), while allowing for different trendliness in each of the regimes. Bond-Blundell includes lagged levels and differences of the dependent variable as instruments, thus 'cleaning up' omitted variables issues. Estimation results show upward and statistically significant trends before and after the AWB, and a downward and statistically significant trend during the AWB period. Projecting the pre-AWB trend forward during the AWB period generates a counterfactual of what would have happened between 1994 and 2004 had the AWB not been in place. Projecting the AWB trend forward generates a counterfactual estimate of the number of mass shooting deaths. The difference between actuals and counterfactuals generates estimates of the number of deaths saved by the AWB. These deaths are valued by using the value of a statistical life (VSL). In the case of school shootings the VSL is
adjusted for the age of the children killed. The final results are a quantification of the dollar value of benefits from reduced deaths attributable to the AWB, and a projected of the dollar value of the lives that would have been saved had the AWB been kept in place from 2005 through 2019.

- Strategies for Controlling Access to Precursor Chemicals to Reduce the Threat of Improvised Explosive Device Attacks; Victoria Greenfield, RAND Corporation
  - This presentation discusses the analysis and recommendations of a research committee formed by the National Academies of Sciences, Engineering, and Medicine to study options for 'Reducing the Threat of Improvised Explosive Device Attacks by Reducing Access to Chemical Explosive Precursors.' Over ten months, the committee worked to establish priorities among precursor chemicals; construct domestic supply chains for certain precursor chemicals; characterize existing policy mechanisms relevant to those chemicals; map the mechanisms along the supply chains to identify potential vulnerabilities; examine analogous domestic and international policies for those and other products; and identify and assess trade-offs among strategies. To support that analysis, the committee gathered data from industry, government, and academia, conducted site visits, and employed principles of risk assessment and benefit-cost analysis. Regarding the latter, it developed a framework for qualitatively evaluating the benefits, costs, and uncertainties of four possible strategies for controlling access to precursor chemicals in relation to three policy goals. The strategies involved different types of control mechanisms, i.e., registries, licenses, bans, and 'business as usual,' with ancillary measures for outreach, training, and reporting. The goals incorporated concerns for security and potential burdens on legitimate commerce use. The committee used the evaluation to rank the strategies by benefits and costs, with reference to underlying uncertainties. Among its recommendations, the committee called for greater oversight of precursor chemicals sold at retail through a multi-chemical approach and an ongoing deliberative process of threat reduction.

7.8 More BCA, Less Sludge
Chair: Randall Lutter, U.S. Food and Drug Administration
Discussant: Joe Devlin, Environment and Climate Change Canada
Presentations:
- The Ascendency of the Cost-Benefit State?; Paul Noe, American Forest & Paper Association, John Graham, University of Indiana, School of Public & Environmental Affairs
  - Our paper argues that there is a great deal of currently unexercised power for the Executive Branch to fully embrace the use of benefit-cost analysis in regulatory decisionmaking, and recommends that the Administration do so, as follows: While perhaps not appreciated until recently, the Trump Administration has an historic opportunity to dramatically advance the cost-benefit state. In 2009, Entergy Corp. v. Riverkeeper, Inc. was an inflection point in the Supreme Court’s treatment of the principles of benefit-cost balancing supported by every president since Ronald Reagan. Against the backdrop of this established, bipartisan administrative practice, the Court reversed what some had argued was a judicially-constructed presumption against benefit-cost balancing unless it was clearly permitted in the statute to reading statutory silence or ambiguity as allowing this type of rational regulation. The progress toward the cost-benefit state continued through the Court’s 2015 Michigan v. EPA decision, which
held that EPA's refusal to consider cost when it had the authority to do so was unreasonable and thus unlawful. The Court now reads 'silences or ambiguities in the language of regulatory statutes as permitting, not forbidding, this type of rational regulation.' This change makes judicial review on this issue consistent with the Chevron doctrine more generally, under which courts defer to agency readings of ambiguous statutes. The importance of clarifying the authority of regulatory agencies to implement statutes through benefit-cost balancing should not be underestimated. Since 1981, every president has required executive agencies to conduct benefit-cost analysis and only regulate if and to the extent it will do more good than harm. The majority of environmental statutes and to our knowledge, of all regulatory statutes are silent or ambiguous on benefit-cost balancing, but all too often, agencies have interpreted their statutes to preclude full compliance with the presidential directives. Following Entergy, Michigan and their progeny, all agencies, including independent agencies, should reinterpret their statutes to fully embrace benefit-cost balancing, unless clearly prohibited by statute. While EPA is considering this invitation and other agencies could follow, the Executive Branch as a whole should fully embrace this extraordinary opportunity through three actions: (1) an overarching directive from the President or OMB for agencies to reinterpret their regulatory statutes to do more good than harm; (2) binding agency regulations channeling their discretion to only do more good than harm, unless clearly prohibited by statute; and (3) binding OMB regulations to ensure the quality of the information agencies use for benefit-cost balancing. We agree with the Supreme Court that it is 'eminently reasonable' to ensure that regulations do more good than harm.

(2) A number of the arguments -- such as the pervasive evasion of the longstanding benefit-cost executive orders and the ability of the Executive Branch to reverse that and unilaterally commit itself to legally binding benefit-cost standards, are new.

(3) and (4) -- our three policy proposals are new, and we believe fully defensible from a policy, technical and legal perspective.

- The Impacts of Environmental Regulations on Technological Innovation; Miriam Matejova, Environment and Climate Change Canada
  - Historically, the conventional wisdom among economists, policymakers, and business managers has been that environmental protection comes at an additional cost to firms, which may erode their global competitiveness. However, according to the Porter Hypothesis (PH), a well-designed environmental regulation can benefit regulated firms it can spur innovation, which can eventually lead to improved efficiency and enhanced competitiveness. While the literature on the PH is vast, the implications of this research are rarely captured in regulatory impact analysis. For instance, the Canadian cost-benefit analysis framework does not consider the benefits of technological innovation due to regulatory action. This study reviews the existing state of literature on the impacts of environmental regulations on technological innovation, with the aim of identifying research gaps. The study also develops a model that assesses the impact of environmental regulations on technological innovation, based on an assessment of a
variety of regulations in Canada. This model has both quantitative and qualitative components. The quantitative component estimates the relationship between the levels of stringency of environmental regulations and the levels of technological innovation expected, whereas the qualitative component describes the nature of technological innovation expected, and possible impacts on efficiency and competitiveness. Both the quantitative and qualitative results from the model can be included in cost-benefit analysis, and presented and discussed in regulatory impact analysis statements.

- **Analysis of Paperwork Burden from U.S. EPA; Amy Lamson, United States Environmental Protection Agency**
  - As of August 2019, the Office of Management and Budget estimated that the total paperwork burden imposed by the federal government exceeded 11 billion hours and $139 billion per year. Cass Sunstein (in ‘Sludge and Ordeals’, 2019) referred to this burden as ‘sludge’ and recommended that institutions conduct ‘sludge audits’ to inform how to reduce paperwork burden. Although reducing paperwork burden is a priority of almost every administration, EPA recently moved this effort a major step forward. In the FY2018-2022 U.S. EPA Strategic Plan, EPA included an ambitious goal to eliminate EPA’s unnecessary or duplicative reporting burdens to the regulated community by 10 million hours by 2022. Currently, EPA has approximately 400 active Information Collection Requests (ICRs) imposing over 170 million hours annually of paperwork burden. In this presentation, we present some of the preliminary findings of what could be characterized as an agency-specific ‘sludge audit’ and the progress (and setbacks) towards the meeting our strategic goal to reduce burden. We review the data on EPA’s ICRs to analyze the distribution of paperwork burden across EPA offices, across ICRs (often reflecting either a programmatic or regulation-specific scope), and type of information collections (e.g., mandatory, voluntary). In addition, we analyze the trends in burden over time and the reasons for the changes, focusing on the changes since October 2017. Finally, we present preliminary analyses of the extent to which recent deregulatory efforts have affected the amount of paperwork burden that EPA imposes. The key findings from these preliminary analyses will provide insight for upcoming efforts to reduce unnecessary paperwork burden at EPA.

- **Reducing EPA’s Paperwork Burden, Lessons Learned; Nena Shaw, United States Environmental Protection Agency, Amy Lamson, United States Environmental Protection Agency**
  - In the FY2018-2022 U.S. EPA Strategic Plan, EPA included an ambitious goal to eliminate EPA’s unnecessary or duplicative reporting burdens to the regulated community by 10 million hours by 2022. Cass Sunstein (in ‘Sludge and Ordeals’, 2019) referred to this burden as ‘sludge’ and recommended that federal agencies conduct ‘sludge audits’ on their contribution to that overall paperwork burden. While EPA’s efforts to reduce paperwork burden are still in progress, the work can best be described as a ‘sludge audit.’ In this presentation, we will share what we have done in our sludge audit including kaizen and Lean events to better understand the EPA processes involved. We will discuss how the effort highlighted the need to develop Agency guidance for valuing the cost of time, which was completed by our National Center for Environmental Protection.
Economics. We will share how the Paperwork Reduction Act and our statutory and regulatory responsibilities create a challenging environment in which to make significant reductions in paperwork burden. These challenges include the impact of a 3-year PRA renewal cycle and complications associated with the different ways ICRs are managed across the Agency. In addition, we discuss prior efforts that have worked to reduce burden such as the E-Manifest rule and the NPDES Electronic Reporting Rule, in addition to new efforts underway to identify opportunities for reduction. Lastly, we highlight the need for more research to understand how what we require to be reported and kept impacts the compliance with the regulation.

7.C Quantifying and Valuing Environmental Health Risks

Chair/Discussant: Lisa A. Robinson, Harvard T.H. Chan School of Public Health

Presentations:
- Valuing the Benefits of Reducing Childhood Lead Exposure—Human Capital, Parental Preferences, or Both?; Ying Zhou, National Center for Environmental Health, Center for Disease Control and Prevention
- Shale Gas Development, Air Quality and Birth Outcomes in Pennsylvania; Alan Krupnick, Resources for the Future
- Quantifying Non-Cancer Risks for Benefits Analysis; Chris Dockins, National Center for Environmental Economics, U.S. Environmental Protection Agency
- What Value Do We Attach to Climate Action?; Alain Quinet, SNCF Reseau

7.D Alleviating Poverty

Chair: Paul Peretz, Claremont Graduate University
Discussant: David Long, Princeton Policy Associates

Presentations:
- Analyzing Proposed Changes to the Ohio State EITC; Rob Moore, Scioto Analysis, Tong Zhou, Scioto Analysis
  - Very few benefit-cost analyses of the earned income tax credit have been conducted, even though it is one of the largest anti-poverty programs deployed in the United States. This study was conducted to analyze how changes to the state earned income tax credit in Ohio would impact social welfare and the cost-effectiveness of these changes as a strategy to reduce poverty and inequality and improve population health and educational attainment. The paper largely analyzes existing data, combining best-practice benefit-cost analytical techniques with cost-effectiveness analytical techniques to provide a multidimensional evaluation of proposed changes to the state earned income tax credit in Ohio. This paper is novel in both its subject matter and locale. While the earned income tax credit has been studied heavily as a tool for poverty alleviation and inducing workforce participation, scant evidence exists of its social welfare impacts. Additionally, this study deals specifically with state-level policy, where benefit-cost analyses are relatively rare. A recent study we conducted on Ohio was unable to find a best-practices benefit-cost analysis conducted in the state in over a decade. Results are still pending for the study, anticipated to be concluded this Fall.
Using Implementation Research to Assess Program Costs: Lessons from Two Evaluations of Programs for Opportunity Youth; Louisa Treskon, MDRC
- There is increasing demand for evaluations of social programs to include analyses of program costs and benefits, but limited resources can present barriers to conducting these analyses. Additionally, social programs focused on improving the educational and employment outcomes of young people who are disconnected from school and work often draw on resources across a network of nonprofits and public systems, which makes it challenging to understand from program financial documents alone the true cost of a single program. Lack of resources and dispersed nature of program services make it particularly difficult for evaluators to rigorously and accurately assess the true costs of operating a program. Such assessments are essential in order to assess the cost effectiveness or net benefit of a program or intervention. This presentation will describe how cost analyses in two evaluations addressed these challenges of limited resources and dispersed services. In particular, the presentation will describe how data collected for implementation research was used for the cost analyses. Implementation research, which focuses on understanding how programs operate in real-world conditions, can provide essential information for understanding the full range of inputs that are required to run a program, including staff, space, overhead, and other supports. The presentation will describe how interview, time use and participation data collected for the evaluation of the Annie E. Casey Foundation’s Learn and Earn to Achieve Potential (LEAP) was used to measure the costs of implementing a program that included staff across multiple partners and public agencies. The presentation will also describe cost study findings from the evaluation of the PACE Center for Girls in Florida. It will demonstrate how implementation and participation data were used to assess the costs of referral services offered by another provider, allowing for the full costs of the intervention to be calculated. The presentation will also describe how implementation research efforts can deepen insights from cost analyses by providing specific information on how resources are allocated across program activities. Lessons on how implementation research can support cost analyses will be useful for researchers seeking strategies to include rigorous methods for cost analyses into evaluation activities.

The Use of Benefit-Cost Analysis in Philanthropic Efforts to Alleviate Poverty; Judy w, University of Minnesota – Twin Cities
- Economic analysis can be used to identify social, health, or educational programs that provide the greatest impact per dollar spent. Increasingly, private investors and donors are engaging in partnerships with either government agencies or local nonprofit organizations to expand effective services based on predictions of realized benefits relative to costs. One approach involves social impact financing with pay-for-success contracts (e.g., Nonprofit Finance Fund, 2019; Temple and Reynolds, 2015) whereby private investors agree to fund promising social services and expect to be paid back by local, state, or federal governments if the services delivered are deemed successful by external evaluators. This paper focuses on an additional use of cost-benefit analysis involving partnerships between private donors and nonprofit service providers in which metrics for estimating return on investment are developed and employed to guide philanthropic giving. Popularized by the Robin Hood Foundation (Weinstein and Bradburd, 2013) and focused entirely on improving the wellbeing of individuals and families living in poverty, several philanthropic organizations around the U.S. have emerged in recent years to allocate private donations to local service providers through
estimates of the benefits likely to be generated by the investment. The key distinction in how CBA is used in these three approaches to funding social services is the concept of standing. In societal CBA, obviously the benefits and costs experienced by society at large (within a specified jurisdiction) are used to compare alternative programs and identify promising uses of public dollars. For social impact financing through pay for success contracts (typically referred to as Pay for Success), the measured benefits consist primarily or entirely of the financial cost savings experienced by taxpayers. For CBA-motivated philanthropic grant making through organizations like the Robin Hood Foundation in New York City, Tipping Point in San Francisco, and the Constellation Fund in Minneapolis, the only benefits that matter are those accruing to individuals and families with incomes less than 185% of the poverty threshold. Non-poor beneficiaries have no standing. Our paper compares and contrasts these economic approaches to identifying cost-effective social programs and provides a number of key illustrative examples from early childhood, housing, or labor market policies. While clearly a key difference is the issue of standing, other differences include the role of evaluation. In explaining how philanthropies are employing CBA methods, we provide multiple examples from the publicly-available set of metrics used to predict spending impacts on the wellbeing of residents living in poverty. Challenges in assessing the likely effectiveness of the service provider and the relevancy of employing effectiveness estimates from national studies for use in local grant making are examined.

7.E Deregulatory BCAs on Food Safety Regulations under E.O. 13771
Chair: Linda Abbott, U.S. Department of Agriculture
Discussant: Donald Kenkel, Council of Economic Advisors
Panel:
- Deregulatory BCAs on Food Safety Regulations under E.O. 13771; April Regonlinski, U.S. Department of Agriculture
  - Under Executive Order 13771 ('Reducing Regulation and Controlling Regulatory Costs,' January 30, 2017), Agencies have focused on comprehensive and common-sense regulatory reform, protecting health and safety while eliminating unnecessary costs. According to the Office of Information and Regulatory Affairs in the Office of Management and Budget, government Agencies in fiscal year 2018 eliminated $23 billion in overall regulatory costs across the government, and issued 176 deregulatory actions and 14 significant regulatory actions (at a ratio of 12 to 1). Furthermore, among the 176 deregulatory actions, 57 were significant; thus comparing significant deregulatory to significant regulatory actions yields a ratio of 4 to 1. Since 2017, USDA/FSIS has published several deregulatory actions. This panel presents an overview of the process and results, exemplified by benefit-cost analyses associated with three deregulatory actions: (1) a rule-making that amended the egg products inspection regulations, which allowed both the industry and the Agency more flexibility in resource utilization; (2) a rule-making that modernized swine slaughter inspection and will result in industry and FSIS cost-savings and potential public health benefits; and (3) a rule-making that removed the requirement that livestock carcasses be marked 'U.S. Inspected and Passed' at the time of inspection within a slaughter establishment for carcasses to be further processed within the same establishment, thus resulting in industry cost-saving without a negative impact on public health.
- The USDA Food Safety and Inspection Service (FSIS) Rule to Amend Egg Products Inspection Regulations; Bryan Maculloch, U.S. Department of Agriculture
• The Hog Carcass Cleaning Rule and Modernization of Swine Slaughter Inspection Rule; Andrew Pugliese, U.S. Department of Agriculture
• Benefit-Cost Analysis for "Elimination of the Requirement That Livestock Carcasses Be Marked 'U.S. Inspected and Passed' at the Time of Inspection within a Slaughter Establishment for Carcasses to be Further Processed within the Same Establishment"; Flora Tsui, U.S. Department of Agriculture

3:30 pm – 3:45 pm  Break
3:45 pm – 5:15 pm  Session 8
8.A Remembering Martin Weitzman and The Challenges He Identified for Benefit-Cost Analysis
Chairs: Al McGartland/Ann Wolverton; Environmental Protection Agency
Panel:
- Bengt Kriström, Swedish University of Agricultural Sciences, Department of Forest Economics, will speak to Marty’s influence on green accounting
- Bob Schmitt, U.S. Department of Energy, will speak as a former student of Marty’s
- Jim Hammitt, Harvard T.H. Chan School of Public Health, will speak to Marty’s influence in the area of discounting over long time horizons
- Alexander Golub, American University, will discuss Marty's research on the fat tail risk and its relevance to the economics of climate change

8.B Nothing is more Practical than Good Theories/Methods - II
Chair: Tom Kniesner, Claremont Graduate University
Discussant: Susan Dudley, George Washington University Regulatory Studies Center
Presentations:
- Estimating Economic Impacts on Small Business (Regulatory Flexibility Analyses); Lauren Masatsugu, Abt Associates Inc.
  o We provide a guide for conducting an analysis of economic impacts on small entities, including analyses required by the Regulatory Flexibility Act (RFA). The purpose of the RFA is to determine that a regulatory action does not have a significant adverse economic impact on a substantial number of small entities. Our guidance covers general RFA requirements, how a small business analysis relates to the broader economic analysis, and options for impact metrics. We also outline a step-by-step process that can be used to conduct a small business analysis, including (1) identifying small entities; (2) obtaining revenues or expenditures for individual entities; (3) assigning costs to regulated entities; and (4) determining impact ratios for small entities.
- Co-Benefits, Countervailing Risks, and Cost-Benefit Analysis; John Graham, Indiana University, Jonathan Wiener, Duke University School of Law
  o The United States has developed a strong system of impact assessment for federal regulatory policies, including attention to both the benefits and costs of such policies. One important issue that arises in this context is whether agencies should assess not only the intended target benefits identified in the authorizing legislation, but also the additional 'co-benefits' or 'countervailing risks' associated with rulemaking. For example, a policy aimed at reducing one pollutant may also yield co-benefits by reducing a second pollutant. In some rulemakings, the quantified co-benefits have exceeded the quantified target benefits. Critics have questioned the estimated magnitude, policy propriety, and legal basis of counting such impacts. Addressing such criticisms requires understanding the multiple purposes of regulatory analyses, which include informing policy makers and the public as well as supporting the legal basis for the rule. These purposes suggest that both the target benefits and ancillary impacts (including co-benefits and countervailing risks) should be counted in an evenhanded manner. Similarly, the full range of costs should be considered, including costs to regulated actors as well as to others and any cost savings. We argue in favor of counting the full portfolio of important policy impacts, both improvements and harms, both target and ancillary - but not endlessly. Rather,
target and ancillary impacts should be assessed to the degree that the analysis improves the information available for decision making, taking into account both the value and the costs of adding of this information. Arbitrarily narrowing the scope of impact assessment (such as omitting important co-benefits, countervailing risks, or social costs) can lead to policy errors and welfare losses. Longstanding executive orders, guidance, and judicial doctrines call on agencies to consider the full suite of impacts, reflecting the substantial utility of such assessments. Our review of three recent rulemakings, however, indicates that agencies do not always consider the full range of important impacts. And, as is the case for impacts that are the direct target of the rulemaking, assessing co-benefits and countervailing risks requires careful consideration of the evidence and associated uncertainties. Executive and judicial oversight should continue to encourage regulatory agencies to count an appropriately broad portfolio of important impacts.

  - A central part of sound impact assessment is to identify and assess the expected costs and benefits that regulatory proposals will have on various economic actors, according to the OECD. At the European Union level, the European Commission - as the EU executive - has the primary responsibility for conducting impact assessments. The Commission's own Better Regulation Guidelines stipulate that 'all relevant impacts should be assessed qualitatively and quantitatively whenever possible. In its 2018 Annual Report, the European Commission’s Regulatory Scrutiny Board (RSB), which scrutinises the Commission draft impact assessments, concluded that 'Commission practices have continued to improve quantification. Currently about a fourth of impact assessments fully quantify costs and benefits. Comparing this statistic with the quantification and monetization efforts of the regulatory system in the U.S., the Commission's figure appears meager at first sight. While the U.S. and the EU regulatory systems display some similarities, they are also characterized by a number of key differences. A one-to-one comparison is not as straightforward as it might seem. Our proposed paper aims to critically examine in what ways the quantification in Commission impact assessments has improved, as suggested by the Commission. It seeks to analyse recent trends and methods in quantification, and also the limitations thereof. What has the Commission done to improve ex-ante quantification, and are its efforts since the adoption of the 2017 Better Regulation Guidelines and its accompanying Better Regulation Toolbox sufficient? What are the limits of quantification? Our proposed paper will build on previous studies and reports, such as by the RSB and the European Commission's Joint Research Centre, but also on a forthcoming study by the European Parliamentary Research Service (EPRS). Further, we will conduct a literature review with a view to integrating how the academic world has perceived the changes undertaken by the Commission in this field. With this contribution, we aim to inform the debates in the U.S. and provide European perspectives and experiences how on economic impacts are evaluated in European Commission impact assessments by means of quantification.

- Benefit-Cost Analysis and Cost-Benefit Analysis: Moral Sentiments and The Potential Compensation Test; Richard Zerbe, University of Washington
This paper notes a growing, if not yet firmly established, distinction between cost-benefit analysis (CBA) and benefit-cost analysis (BCA). BCA is distinguished from CBA in its inclusion of the realization of moral sentiments for which there is a willingness to pay, and in its dropping of the potential compensation test (PCT). The PCT is an unnecessary, confusing, and morally suspect justification for project acceptance of BCA. The test has been the source of extended criticisms in the legal and philosophy literature. The better justification for using BCA is the actual Pareto test, called the Consent Justification, in combination with the net present value (NPV) for individual projects. The PCT is based not on actual potential compensation as no account is taken of carrying out compensation. The Consent Justification is based on a tendency toward actual compensation. This conclusion is based on a brief recounting of the history of the development of CBA and of BCA, along with discussions of the criticisms to be made of the PCT. The paper offers a proof showing difficulties that can arise with hypothetical justification used by the PCT. The consent justification is strengthened by the proof of a theorem modeled on the Arrow-Lind Theorem for Consent Justification, along with a simulation supporting the Consent Justification.

8.C Big Implications of Tiny Items: Regulating Particulates

The U.S. Environmental Protection Agency recently proposed to exclude particulate matter (‘PM2.5’) co-benefits from a supplemental finding that the Obama Administration’s Mercury Rule is not "appropriate and necessary." That decision is drawing new attention to the question of which co-benefits are appropriate for the benefit-cost analysis of environmental regulations. Some experts agree with EPA that it should not give equal weight to ancillary benefits caused by incidental reductions of pollutants like PM2.5 that are not the target of the subject regulation. EPA’s national ambient air quality standard (‘NAAQS’) already controls PM2.5 to the degree EPA deems ‘requisite to protect the public health’ with ‘an adequate margin of safety.’ Some argue that PM reductions below that level cannot possibly yield the same degree of health benefits as reduction in non-compliant areas. And reductions in non-compliant areas have already been counted as benefits of the NAAQS, so counting them as co-benefits of another rule amounts to double-counting. Other experts defend EPA’s traditional reliance on co-benefits as necessary to fully account for the benefits of environmental regulation and to treat benefits and costs consistently as dictated by principles of cost-benefit analysis. Objections to co-benefits should be dealt with by addressing the merits of the underlying science, not categorically excluding co-benefits. Co-benefit accounting is an important subject for academics and policy-makers because, in recent years, particulate-matter co-benefits have dominated benefit-cost analyses in support of EPA regulations. EPA’s decision not to rely on PM co-benefits to justify Hazardous Air Pollutant regulation could signal a major change in its approach to air quality regulation.

Chair: Laura Stanley, George Washington University, Regulatory Studies Center

Presenters:
- Adam Gustafson, Boyden Gray & Associates PLLC
- Caroline Cecot, Antonin Scalia Law School, George Mason University
- Brian Mannix, George Washington University Regulatory Studies Center
- Connor Raso, Securities and Exchange Commission & Georgetown Law
8.D Roundtable Discussion: Optimal Allocation of Resources in Regulatory Analysis Review

Review of regulatory analysis is one way to improve the quality of that analysis and the information available to decisionmakers. Given limited resources for review, how can we most efficiently improve the quality and relevance of analysis across agencies and regulations? This roundtable will discuss the overarching goals of the review process and the potential effectiveness of different strategies for achieving them. These strategies must consider such factors as the amount of rulemaking carried out by different agencies and offices, the economic and policy impact of rules, diminishing returns to improved quality of analysis, and the incentives of regulatory agencies. Other considerations include the trade-off between sophistication and accessibility of analysis, differences between Regulatory Flexibility Act (RFA) and EO 12866 analysis, regulatory thresholds such as certification under the RFA, the usefulness of early review such as small business advocacy review panels in the Small Business Regulatory Enforcement Fairness Act (SBREFA) process, and the role of organizational pressure in allocating resources objectively.

Chair: Elisabeth Newcomb, Small Business Administration Office of Advocacy

Panel:
- Oliver Sherouse, Small Business Administration Office of Advocacy
- Amber Jessup, ASPE/HHS
- Michael McManus, OIRA/OMB
- Jerry Ellig, George Washington University Regulatory Studies Center

8.E The Economics of Economic Analysis in Government

This session consists of four papers that examine the organization of economic analysis in government and present new research on analytical methods. The Ellig paper will present new research results on the relationship between the organizational structure of economists and the quality and influence of economic analysis on regulation, based on a report he conducted for the Administrative Conference of the United States. The Xie, Carrigan, and Ellig paper assesses whether the quality of an agency’s regulatory impact analysis affects the likelihood that a regulation will be overturned in court. The Mannix paper presents a new basis for distinguishing between economic and social regulation. The Febrizio and Xie paper assesses whether different types of regulations have different effects on manufacturing productivity, which holds implications both for regulatory design and for regulatory analysis.

Chair: Glenn Blomquist University of Kentucky

Discussant: John Powers, Public Company Accounting Oversight Board (PCAOB)

Presentations:
- The Organization of Economists at Federal Regulatory Agencies; Jerry Ellig, GWU Regulatory Studies Center
- Regulatory Impact Analysis and Judicial Review; Zhoudan Xie, George Washington University Regulatory Studies Center
- Does the Relationship Between Regulation and Manufacturing Productivity Differ by the Form of Regulation?; Mark Febrizio, George Washington University Regulatory Studies Center
POST-CONFERENCE WORKSHOPS

Wednesday, March 18

*Post-Conference Workshops required separate registration and is not included in the Annual Conference registration.

8:00 am – 9:00 am Registration for full-day and half-day workshops

9:00 am – 12:30 pm Professional Development Workshops


• Workshop participants will gain a better understanding of the institutional context for deregulatory analysis, the general approach used to prepare such analyses, and the strengths and limitations of analyses they review.

Workshop 2: Benefit-Cost Analysis for Beginners; Organized by Glenn Blomquist, University of Kentucky

• The purpose of the workshop is to provide an introduction to the theory and practice of BCA for those who have not previously received any formal instruction. Participants will become familiar with the basics of BCA.


• Benefit-cost analysis is used around the world to assess regulatory impacts. This workshop introduces the use of Benefit-Cost Analysis for Regulatory Impact Analyses (RIAs) in the Federal government. The topics will include issues of identifying the market failure, establishing the correct baseline, choosing the policy options, estimating benefits, estimating costs, and identifying transfers. The focus will on analyses of U.S. environmental, health, and safety regulations issued by the Environmental Protection Agency (EPA) in the last two decades, but the concepts and practices we discuss are equally applicable to analyses conducted in other policy areas and in other countries or at a sub-national level. The workshop will structured as an overarching presentation with examples from past EPA RIAs used as practical example to be discussed by the participants.

12:30 pm – 1:45 pm Lunch Break

12:45 pm – 1:45 pm Afternoon Workshop Registration

1:45 pm – 5:15pm Professional Development Workshops


• Workshop participants will gain a better understanding of the tools and methods available for addressing uncertainty and non-quantified effects in benefit-cost analyses. We will review qualitative and quantitative methods and provide real-world examples of their application in the development of public policy.
Workshop 5: A Voice Crying in the Wilderness? Techniques for Promoting the Use of Evidence and BCA Results to Policymakers; Organized by Steven Lize, *The Pew Charitable Trusts*

- Participants will learn strategies and techniques to communicate to government decision makers complicated economic evaluation concepts and findings from analyses. Participants will learn from lecture presentations, discussion, and group collaboration. Presenters will employ examples from the county, state, and federal government agencies in the United States, and perspectives on government in other countries. Participants will have the opportunity to work on reporting their own data and analysis findings with the hands-on guidance of the workshop presenters.


- Workshop will familiarize participants with different approaches to valuing health and longevity in benefit-cost analysis, including the conceptual framework, measurement methods, and application challenges.