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Guidance on Assessing Distributional Effects

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Preface

This study builds on prior work, *Benefit-Cost Analysis and Consideration of Distributional Effects and Social Equity* (MP210978), which focused on current practices of applying Benefit-cost analysis (BCA) to prioritize both federal and state government actions, existing methods for identifying distributional effects, and areas within the BCA framework that could be improved to address social equity [1].

While this report focuses on developing the methodology for assessing distributional effects, this work is expected to continue beyond this document, ideally building upon this methodology to expand the BCA framework to address social equity both within BCA and throughout the planning process.

Further investigation is recommended to understand the quantitative accounting of social equity using indicators, weights or indexes of inequality, and then providing the results to an expert opinion elicitation panel and stakeholders (with a neutral third-party as the lead organization) to get feedback and consensus on how social equity should be considered.

The developed methodology could be tested with government partners by preparing various case studies, ideally using proposed government actions that are currently under consideration. A use case that studies an implemented government action could also be helpful for understanding whether the intended outcomes materialized.

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1. Introduction

Benefit-cost analysis (BCA) is a pragmatic framework designed to enable the formal comparison of disparate benefits and costs using the same metric—money. Various methods, based in economic theory, can be used to monetize goods and services not sold in traditional markets. Monetary valuations of these non-market goods and services are useful for measuring the extent individuals are willing to exchange income for specific outcomes if they could be directly bought and sold. When quantification of a potentially important effect is not possible, costs and/or benefits can be addressed qualitatively [2].

BCA is intended to evaluate the economic efficiency (maximizing scarce resources given the preferences of individuals) and magnitude of a proposed action by aggregating the effects across individuals. When multiple alternative scenarios are compared to the same baseline over the period of analysis, BCA can inform the selection of the alternative scenario that maximizes economic, social, and environmental benefits on a cumulative basis; however, using only aggregated outcomes from BCA does not identify who bears the costs and who receives the benefits and when. A distributional effects analysis is necessary to evaluate who "gains" and who "loses" because those that bear the costs may or may not equally receive the benefits. Distributional effects, as broadly defined by the Office of Management and Budget (OMB), are how the benefits and costs are distributed across society, disaggregated by characteristics of interest or concern (e.g., income, race, sex, age, geography).

BCA has been widely used in the evaluation of proposed government funded projects, discretionary funding programs (both federal and state), and policies affecting transportation, public health, criminal justice, defense, education, and the environment. Analyzing the distributional effects after conducting BCA is imperative to understanding the significance of a government action on social equity, meaning whether the distribution of the benefits and costs is "fair." This guidance document is focused on how a distributional analysis can be performed to supplement BCA.

1.1 Federal Regulations

In 1982, the executive branch formalized the inclusion of economic efficiency in the regulatory approval process with President Reagan's signing of Executive Order (EO) 12291. In 1993, President Clinton signed EO 12866, which modified EO 12291 by emphasizing the non-quantitative effects of rules but maintained benefit-cost requirements for all economically significant rules [3]. The key change introduced by Clinton was a requirement that benefits "justify" costs [4].

These executive orders require a Regulatory Impact Analysis (RIA) for all major rules. An RIA is intended to include an evaluation of the need for and consequences of the proposed regulation. An RIA should include consideration of alternative regulatory approaches; quantification of the economic costs and benefits within a BCA framework; determination of economic impacts and distributional effects; and a discussion of costs and benefits that cannot be quantified, with an assessment of their importance relative to those that are quantified or monetized.

When conducting RIAs in support of rulemaking, federal agencies are essentially seeking to address issues of *efficiency* (maximizing net social benefits) and *distributional consequences*. BCA estimates the net benefits to society, whereas economic impact analysis (EIA) and distributional analyses examine the effects of the proposed regulation on various economic sectors or subpopulations, respectively. Specifically, an EIA estimates the impacts to industry, governments,

and non-profit organizations, whereas a distributional analysis examines the effects on various sub-populations, particularly low-income, minorities, and children. A complete RIA comprises a BCA, an EIA, and an assessment of distributional effects [5].

All RIAs are sent to OMB for review as authorized by EO 12291. OMB is responsible for reviewing the regulation and accompanying analyses before they are finalized and has issued guidance on "best practices" in preparing an RIA. The latest such guidance is *Circular A-4* [2]. *Circular A-4* was designed to standardize the measurement and reporting of benefits and costs of regulatory actions. In addition to a BCA, OMB guidance directs agencies to provide an analysis of the distributional effects of the regulation.[1] If the distributional effects are expected to be significant, OMB specifically calls for a description of "the magnitude, likelihood, and severity of impacts" on particular groups [2].

Explicit language to consider distributional effects and equity is included in President Clinton's EO 12866 and EO 13563 signed by President Obama [6]. Despite the strong interest in distributive impacts, especially adverse impacts on disadvantaged or vulnerable populations, standard practice has been to document aggregated benefits and costs to whomsoever they may accrue [7], [8].

President Biden issued a memorandum dated January 20, 2021, which directs the Director of OMB, in consultation with representatives of executive departments and agencies, to develop recommendations for improving and modernizing regulatory review to "…promote public health and safety, economic growth, social welfare, racial justice, environmental stewardship, human dignity, equity, and the interest of future generations. [9]" Two subsequent executive orders—EO 13985 and EO 14008—use nearly identical language in stressing the importance of addressing social equity and environmental and economic justice for underserved communities [10], [11].

1.2 State Regulations

The use of BCA to support regulatory decision-making varies greatly in form, quality, and effectiveness at the state, county, and municipal levels of government. A nationwide assessment performed between 2008 and 2011 found that state governments are increasingly mandating and conducting BCAs, although most of the 348 BCAs reviewed lacked at least some of the desired technical aspects of BCA [12]. States reported resource and data limitations, timing considerations, and difficulty in gaining policymakers' attention and confidence as key challenges. Notwithstanding, a notable proportion of the BCAs had a reported impact on state policy and budget processes [12].

The Institute for Policy Integrity studied and surveyed all 50 states and found that most state agencies struggle to assess the basic costs of regulations and completely forgo any rigorous analysis of benefits or alternative policy choices [13]. Furthermore, broader and more balanced distributional assessments, beyond the distribution of costs and benefits to different sized businesses, were rare.

[1] Circular A-4 states: "Your regulatory analysis should provide a separate description of distributional effects (i.e., how both benefits and costs are distributed among sub-populations of particular concern) so that decision makers can properly consider them along with the effects on economic efficiency. Executive Order 12866 authorizes this approach. Where distributive effects are thought to be important, the effects of various regulatory alternatives should be described quantitatively to the extent possible, including the magnitude, likelihood, and severity of impacts on particular groups." (P. 14)

1.3 Government Spending

The Flood Control Act of 1936, Public Law 74-738, requires the federal government to participate in flood risk management when "the [project] benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected." This Act authorized federally funded flood control projects and set the criterion of benefits exceeding costs and the consideration of social impacts in the decision-making process. Water resource development agencies, such as the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, Natural Resources Conservation Service, and the Tennessee Valley Authority, are required to conduct detailed BCAs for individual project justification. Distributional effects are typically not identified, nor is a distributional analysis required.

Passed in 1977, the Federal Grant and Cooperative Agreement Act guides government agencies in their use of federal funds, such as grants and cooperative agreements. Grant-making federal agencies create agency-specific policies and procedures based on guidance from OMB [14]. Some of the grant-making federal agencies, such as the U.S. Department of Transportation (DOT), Federal Emergency Management Agency (FEMA) and Federal Aviation Administration (FAA), require grant applicants to perform BCAs for their proposed project. Grant-making federal agencies that require BCAs typically provide guidance for conducting the BCA, including specific methods and monetized values that are approved for use. Usually, the distribution of benefits and costs is not explicitly quantified in applications; rather, affected populations may be identified (vehicle owners, residents, drivers and passengers, pedestrians, etc.) for each benefit category (e.g., travel time savings).

Using BCA to evaluate projects is a more common approach for federal agencies than at the state, county, and municipal levels of government. A study performed by DOT in response to Senate Report 113-182 to "evaluate the use of benefit cost analysis by State departments of transportation, and to issue a report to the House and Senate Committees on Appropriations" found significant variation in the extent to which state departments of transportation use BCA, both across states and across different project types and planning stages, and that the use of BCA and identification of distributive effects continues to be the exception, not the rule [15].

1.4 Federal and State Guidance on Distributional Effects

In the realm of regulations intended to reduce health-risks, the analysis of health benefits is considered a mature field with a strong conceptual foundation for quantifying inequality in health outcomes [16]. Moreover, the Environmental Protection Agency (EPA) *Guidelines for Preparing Economic Analyses* devotes a chapter to *Environmental Justice, Children's Environmental Health and Other Distributional Considerations* and outlines the approach an analyst should take to address distributional effects quantitatively or qualitatively, including metric definitions, sources of data, and analysis methods [5]. Similarly, the Department of Health and Human Services (HHS) offers guidance on assessing distributional effects in the *Guidelines for Regulatory Impact Analysis* [17]. Both documents tend to focus on exposure or health effects and were the only federal guidance on distributive effects authors found: no state guidance was found.

1.5 Guidance on Distributional Effects from Other Countries

The review of foreign country distributive effects guidance was limited to guidance available in English, therefore it is not a full accounting of countries that may or may not provide guidance on distributive effects.

Her Majesty's Treasury (HMT) is the United Kingdom (UK) economic and finance ministry. HMT released *The Green Book, Central Government Guidance on Appraisal and Evaluation* as guidance on how to evaluate policies, programs, and projects [18]. The guidance includes information on how to conduct distributional effects analysis and supports the use of applying distributional weights and equivalization techniques. Equivalization allows comparisons of individuals from different ages and different sized households.

For regulations, the Treasury Board of Canada Secretariat requires the identification of how impacts are distributed across affected parties. Although the *Canadian Cost-Benefit Analysis Guide* references the identification of distributive effects, a detailed methodology was not found [19]. Statistics Canada produced a report on guidelines for the distribution of income that analyzes the advantages and disadvantages of various measures for income inequality, income polarization, and low income, and recommends the consideration of multiple measures [20].

In the *Handbook of Cost Benefit Analysis*, the Commonwealth of Australia provides guidance on analyzing the distributional effects, including the incorporation of distributional weights [21]. The two main techniques recommended for estimating distributional weights are (1) postulating weights, and (2) inferring weights from existing or past polices and decisions. The postulated weights would imply a clear policy objective to redistribute income to a particular target group from other groups [21].

2. General Guidance for Analyzing Distributive Effects

BCA is intended to evaluate the economic efficiency and magnitude of a proposed action on social welfare by aggregating the effects across individuals, whereas an analysis of the distributive effects is used to understand the incidence of the benefits and costs. The distributive effects analysis supplements BCA by providing objective, descriptive information to support sound decision-making; it is not intended to include normative judgments about social equity. This information allows decision-makers to consider the trade-offs between economic efficiency and distributional impacts.

Determining how much of the benefits received or the costs incurred are associated with subgroups of society presents a challenge in analyzing distributional consequences. Figure 1 lists the general steps for performing distributive effects analysis. These steps may be performed in succession or may be an iterative process. The level of detail and the extent to which the analysis is quantitative or qualitative should be commensurate with the anticipated magnitude of the effects, available data, and analytical resources. A simplified methodology may be more appropriate for smaller scale government actions, such as small public projects where the BCA may be performed by state, county, or municipal levels of government applying for federal grant programs. Although this type of approach would not be comprehensive, it would move the needle toward the consideration of distributive effects instead of omitting it completely. A comprehensive approach would be appropriate for widespread federal regulatory policies.

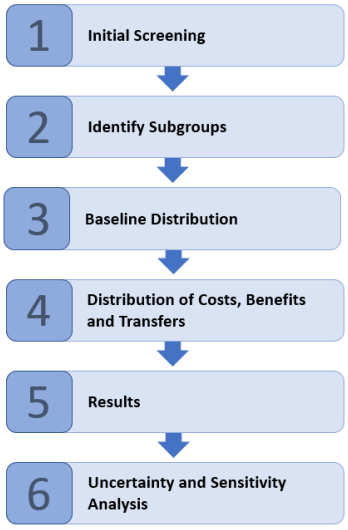

Figure 1. Distributive Effects Analysis

The following guidance is based on the existing approaches described by EPA, HHS, UK government, and various analyses performed in academic literature. This guidance is limited to the analysis of distributive effects after the completion of a BCA and does not describe the methods used within BCA to monetize costs and benefits. The *Benefit-Cost Analysis and Consideration of Distributional Effects and Social Equity* appendices provide more information on the basic steps of BCA and the total economic framework used by economists to estimate the monetary value of goods and services not traded in markets [1].

2.1 Step 1: Initial Screening

The initial screening may be performed at the early stages of the planning process to consider distributive effects during the formulation of alternative scenarios—mitigating potential consequences in the design of the alternative scenarios or ruling out certain scenarios completely. Otherwise, the initial screening may be performed after the completion of the BCA as the beginning of the distributive effects analysis.

An initial screening can help identify potential distributive effects (positive or negative) and assign a rough order of magnitude to prioritize detailed studies for effects that are expected to be the most significant or of greatest concern. The purpose of a detailed study is to reduce uncertainty by quantifying potential effects and their likelihood of occurrence. A detailed study may involve the collection of additional data, refining the methods employed, and expanding the scope of the analysis [17].

To cast a wide net of possibilities that may otherwise be missed, the initial screening should involve stakeholders and various perspectives beyond the analyst. During the BCA process, some of the distributive effects may surface while others may require the formulation of various assumptions to gain preliminary insights. Screening questions may be used to consider the upper and lower bound possibilities. Using the maximum and minimum values to consider potential effects can offer insight into the significance (e.g., worst-case and best-case scenarios) and estimates of the likelihood of occurrence. This type of evaluation can shed light on whether various outcomes are likely to be significant even under extreme assumptions.

The distributive effects analysis may be limited by budget and/or time constraints that restrict resources available for detailed study. It is important to consider which particular aspects will influence decision-making and allocate resources appropriately. In some cases, the cost of further investigation could exceed the likely benefit of assessing it [22]. Therefore, the initial screening can facilitate prioritization of resources.

The results of the screening analysis should be documented for all identified impacts of concern, including the expected direction (positive of negative) and magnitude, and the justification for further investigation when warranted. When it is not possible to quantify an effect, the expected direction and magnitude should be described qualitatively.

2.2 Step 2: Identify Subgroups

In BCA, the total population is considered as a whole, whereas distributive effects analysis defines subgroups of the population with specific attributes. The definition of the subgroups will be specific to the types of scenarios being evaluated by the BCA, the interests of the stakeholders, and interests of the decision-makers. Subgroups may be characterized by income, geography, race, gender, age, occupation, education, marriage/family status, size of household, or other demographic or socioeconomic characteristics. In addition to population subgroups, the distributive effects on businesses may also be relevant, such as type of industry, type of

commodity, and size of business. A subgroup could be a specific geographical area or subgroups within a geographic area. Consider whether there may be heterogeneity within the subgroup that may result in a disproportionate share of the benefits or costs compared to others within the subgroup.

Sometimes these delineations may be obvious, such as a policy aimed at a disadvantaged population or targeting a population in a specific region. However, the distributive effects analysis may illuminate unintentional consequences or collateral effects on a particular subgroup or geographic area. Instead of focusing only on a particular subset (such as disadvantaged groups), it is important to consider the broader distribution of costs and benefits among the entire population. For example, focusing only on the benefits to a segment of the population may divert attention from the distribution of costs or unintentional consequences that may impact another segment of the population or costs may be transferred from one group to another. Stakeholders can help identify subgroups and avoid misidentifying or excluding subgroups.

2.3 Step 3: Baseline Distribution

The expected distribution of outcomes after the implementation of the proposed action should be compared to the baseline distribution of outcomes with the action to understand whether the proposed action improves or deteriorates conditions for each subgroup. Similar to BCA, distributive effects analysis compares the alternative scenarios to the baseline to elicit how the incremental costs and benefits are distributed among the subgroups identified in the previous step. The period of analysis should be consistent with the period of analysis used in the BCA.

Historical data may be used to forecast the baseline distribution. The premise for the baseline is that the current conditions or historical trend will continue into the future, all other things being equal. When data is not available, surveys can be used to gather data on current conditions.

2.4 Step 4: Distribution of Costs, Benefits, and Transfers

2.4.1 Distribution of Costs

Incremental costs are the inputs (e.g., labor, materials) and/or investments needed to implement the government action. Cost-savings or costs avoided are included in this category and may offset investment costs. For each action (alternative scenario) evaluated using BCA, the distributive effects analysis aims to explain how the costs are distributed among each identified subgroup and the ultimate effect on disposable income. Information on project financing can help inform the distribution of costs across categories of interest [23]. Funding for the government action may come from changes in taxes or user fees.

If costs are imposed on businesses, it is necessary to understand how these costs translate into changes in unit prices paid by consumers, changes to wages paid to employees, and returns to capital that accrue to business owners [17]. Businesses may be able to adapt to costs over the long run but may have more acute impacts immediately following the imposition of costs, such as regulations that require capital improvements to reduce emissions. It may be useful to interview affected businesses to understand how these costs will impact different industries and sizes of business. Market responses to price changes, such as income and substitution effects, should also

be considered.[2] When the effect is substantial enough to affect prices and outputs in other sectors, a general equilibrium model may be used to capture these effects.[3]

From a market structure point of view, dominant firms may be in a better position to comply with new policies that impose new costs of doing business than smaller businesses, which may include minority-owned businesses. New policies may lead to increased market concentration and may enable larger incumbent firms to use the new regulation as an additional barrier to entry.

2.4.2 Distribution of Benefits

Incremental benefits are the outputs or outcomes of the government action. The distribution of the benefits should be quantified (e.g., number of individuals), if not monetized to the extent possible. When quantification is not possible, qualitative assessment is appropriate. The BCA and initial screening process should identify benefits; however, the overall analysis may be iterative as new information presents.

The challenge is to identify how the benefits are allocated among the previously identified subgroups, which may depend on the effectiveness of the government action and the baseline distribution [22]. Studies conducted for the BCA may provide data on the distribution or reference relevant data for the identified subgroups. If benefit estimates are calculated using demand or supply functions, then these models can include demographic variables in the statistical analysis to determine distributional effects. Surveys can be used to estimate how benefits vary across demographic characteristics or geographical areas of interest [23]. Otherwise, the analyst may use the assumptions developed during the initial screening and other sources of information to examine the implications of associated uncertainties.

Once the distribution is known or assumptions have been defined for the distribution, the same methods used to monetize benefits in BCA may be applied to monetize distributional effects; however, population-average values should be adjusted to reflect the preferences of individuals with differing characteristics. For example, using population averages for willingness to pay (WTP) values may overstate the values held by poorer individuals and understate the values held by wealthier individuals, obscuring whether the benefits to an individual are greater or less than their costs [22]. Behavioral responses to the government action should also be considered because changes can affect the distribution of benefits.

2.4.3 Distribution of Transfers

A transfer is the movement of resources from one party to another, with no net gain or loss to the total resources available to society. Transfer payments are not included in BCA; however, these types of transactions should be accounted for in distributional analysis because transfers affect the allocation of resources. Transfers may lead to behavioral changes that significantly affect resource allocation and the calculation of total costs and benefits [22]. Taxes are a type of transfer from taxpayers to government. There are also administrative, compliance and enforcement costs associated with taxes. Even when transfers cannot be monetized, the transfers and the subgroups that receive and provide the transfers should be identified.

[2] If a good increases in price, the good is relatively more expensive than alternative goods, and therefore people will switch to other goods which are now relatively cheaper; this is the substitution effect. In addition, the increase in price effectively reduces disposable income and this lower income may reduce demand; this is the income effect [39].

[3] Note, however, that general equilibrium models can be costly to construct, and should only be considered if significant cross-sectoral impacts are expected.

2.5 Quantitative Methods

The methods used to quantify the distributive effects should be detailed in a report that describes the distributive effects analysis. An overview of the bounding method and econometric modeling is provided, but these are not intended to be a full accounting of all the quantitative methods that may be employed in distributive effects analysis. Analysts should consider and leverage the information and data provided through the BCA, for example, a transportation project may include a traffic or network analysis that may be used to identify the distributive effects.

2.5.1 Bounding Method

When insufficient data is available, bounding analysis can be used to investigate the potential consequences. Upper-bound and lower-bound estimates of parameter values can be used to determine whether specific impacts may be significant. For example, a tax increase causes prices of goods to increase. The upper-bound limit could assume consumption levels do not change when prices increase, even though (depending on the type of good) some individuals may respond by cutting consumption or substituting with other goods that may have a lower quality but comparable price to a similar good prior to the new tax (to minimize loss to disposable income). A lower-bound for the same example may be a dramatic decrease in consumption in response to the increased price. If only the decreased demand is considered, it misses the economic loss attached to the value of the consumption that is lost by the adjustment. However, using this bounding technique captures the loss in consumer surplus between the upper and lower bounds.[4]

2.5.2 Econometric Modeling

Econometric modeling can be used to understand the distributive effects by measuring the correlation between two or more variables. In terms of distributive effects, a correlation between the dependent variable that measures implementation of the action and independent (explanatory) variables measuring impacts on subgroups can indicate a distributive effect.

Partial-equilibrium or general equilibrium models may be used to quantify the distributional effects. Partial equilibrium models are useful for understanding the effects of changes in the supply and demand for a specific good or service. These models do not capture the impacts to the rest of the economy; therefore, they are most useful when only small effects in the rest of the economy are expected. General equilibrium models are more complex than partial equilibrium models and can be used to understand the relationships among key variables in the economy. Estimating the change to one variable can demonstrate the effect on interrelated variables. General equilibrium models typically simulate the production sectors of the economy subject to various demand equations; however, they are not designed to capture welfare effects (e.g., non-market effects, consumer surpluses, externalities).

[4] Consumer surplus is the excess of the benefit a consumer gains from purchases of goods over the amount paid for them.

2.6 Qualitative Approaches

When historical data is not available or when a significant change would make the use of historical data questionable, qualitative approaches may be used. There are various qualitative approaches, such as the Delphi method, expert judgment, and scenario approaches. Additional information may be obtained from surveys of the identified subgroups.

2.6.1 Delphi Method

The Delphi method employs a panel of experts that are asked to anonymously respond to a series of questions within their area of expertise [24]. The responses are tabulated and used to prepare a second questionnaire that contains information and opinions from the entire group. Each expert is then asked to reconsider and possibly revise their initial response considering the information provided. This process continues until some degree of consensus has been reached. The purpose of this method is to produce a narrow spread of opinions where most experts concur.

2.6.2 Expert Judgment

Expert judgment from a single subject matter expert or consensus from multiple experts may be used when historical data or conditions cannot be used to predict future outcomes due to changing conditions or data gaps. These opinions can be elicited through interviews or surveys. In some cases, subject matter experts may be able to perform ranking using a Likert scale. The Likert scale is a bipolar scaling method that can be used to measure the level of agreement/disagreement (e.g., 1. Strongly agree, 2. Agree, 3. Neutral, 4. Disagree, 5. Strongly disagree). When selecting subject matter experts, consider any potential biases that may impact their responses.

2.6.3 Potential Outcome Scenarios

Using well defined assumptions, various scenarios can be developed to explore potential outcomes. Changing the assumptions may produce additional scenarios to consider. The analyst would then estimate the likelihood of each scenario occurring and whether this information requires more detailed examination and study.

2.7 Step 5: Results

The distributive effects analysis supplements BCA and the results should be transparent, clearly informing decision-makers of the potential distributional effects and implications based on available information and related uncertainties.

The qualitative aspects of the distributive effects analysis should be described along with the quantified results. The quantified results of the distributive effects analysis may include the annualized and present value of costs, annualized and present value of benefits, net present value (NPV), and benefit-cost ratio (BCR) for each identified subgroup. The summation of the NPV across subgroups should equal the NPV from the BCA (society as a whole). The NPV is calculated as the present value of benefits minus the present value of costs to members of each population subgroup. NPV can demonstrate potentially counterbalancing impacts. The BCR is calculated as the present value of benefits divided by the present value of costs. A BCR greater than one indicates cost-effectiveness. Table 1 is an example of an alternative scenario results.

Table 1. Example of Results for an Alternative Scenario

Subgroup	Number of Households	Costs per Household	Benefits per Household	Net Present Value	Benefit-Cost Ratio
Income Quartile 1	20,000	$5	$50	$45	10.0
Income Quartile 2	80,000	$10	$40	$30	4.0
Income Quartile 3	60,000	$30	$30	$0	1.0
Income Quartile 4	10,000	$40	$20	-$20	0.5
Total	170,000	$85	$140	$55	1.65

Note: Numbers are for illustrative purposes only. Costs and benefits are intended to represent present value.

The findings should enable decision-makers to balance distributional concerns with other impacts and allow them to address the concerns by taking certain action (e.g., development of a mechanism to mitigate impacts). The results may or may not justify the selection of an action that may be less economically efficient but have a preferable distribution of costs and/or benefits.

2.8 Step 6: Uncertainty and Sensitivity Analysis

Uncertainty can be addressed both qualitatively and quantitatively. Describing the key uncertainties in the analysis and the extent to which these uncertainties affect the results can generate confidence in the results and an understanding of the significance of any bias. Key assumptions, data sources, and methods should be described in the context of advantages and limitations.

When evaluating multiple scenarios, it is important to address the extent to which uncertainties affect the relative ranking of the evaluated scenarios. Effects that are not quantified should be discussed qualitatively and to the extent possible, categorized or ranked in terms of magnitude and importance, including whether they increase or decrease the net benefits.

Sensitivity analysis can be used to illustrate the implications of uncertainties. Key values or assumptions can be changed to explore whether these values significantly affect the results. Alternatively, some inputs can be represented by probability distributions that account for the range of potential values and probabilities associated with each value (if they are known or reasonably estimated). A Monte Carlo simulation can be used to generate results demonstrating the probability of each possible outcome.

In Monte Carlo simulation, values are sampled at random from the input probability distributions. A simulation of thousands of iterations generates expected values and confidence intervals. This type of analysis provides a more complete understanding of what may happen by providing not only the possible results but also the probability of how likely they are to occur.

2.9 Data Sources

Data used to develop the BCA and other related prior assessments will be the basis for developing the distributive effects analysis and may need to be supplemented with additional sources of data and/or information from surveys, interviews, and elicitations from subject matter experts. Each agency has familiarity with data sources specific to its sector or industry domain; however, the

following data sources and online tools may be used to identify the demographics of affected parties.

The American Community Survey (ACS) administered by U.S. Census Bureau provides annual estimates of socioeconomic information for geographic areas with more than 65,000 people, three-year estimates for areas with 20,000 or more people, and five-year estimates for all areas. The five-year estimates, which are based on the largest sample, are the most reliable and are available at the census tract and block group levels [5].

The U.S. Census Bureau's American Housing Survey (AHS), is a housing unit survey that provides data on a wide range of housing and demographic characteristics, including information on renters. Unlike the ACS, which selects a random sample every year, the AHS returns to the same 50,000 to 60,000 housing units every two years [5].

The U.S. Department of Health and Human Services (HHS) maintains population databases on the characteristics of individuals that experience various types of health effects, including the National Health Interview Survey and the Medical Expenditure Panel Survey [17].

The U.S. Environmental Protection Agency (EPA) maintains the Environmental Justice Screening and Mapping Tool (EJSCREEN) which combines environmental and demographic indicators in maps and reports [25].

The U.S. Department of Transportation (DOT) defines "areas of persistent poverty" at the county and census tract level (and includes all U.S. territories) for determining eligibility for the RAISE grant program. These areas can be queried using the RAISE Persistent Poverty Project Status Tool [26].

In addition, **state, regional, and local governments and organizations** may identify areas of interest based on demographics. For example, the Metropolitan Washington Council of Governments' Transportation Planning Board defines "equity emphasis areas" for prioritization of public transportation investment and service [27].

3. Case Studies of Distributive Effects

Distributional effects may be present in policies and projects for a broad set of sectors. The following case studies illustrate how distributional effects may enter the calculus. Each case study will briefly describe the problem being addressed, the potential solutions, methods and data used to perform the distributive effects analysis, and results/findings.

These case studies illustrate the importance of conducting distributive effects analysis to illuminate information that may otherwise be missed, impacting the selection of various alternative scenarios. For example, some highways, bridges, railways, and other major transportation facilities have been planned using traditional BCA methods without conducting distributive effects analysis to understand how the project may impact certain demographic groups. When considering the least-cost alignment of new rights-of-way through a populated area, traditional BCA calculations would indicate a recommendation of alignments that run through property with the lowest appraised value. This may result in displacement of low-income property owners or tenants, as well as bifurcation of disadvantaged communities or separation of those neighborhoods from adjacent employment centers, public amenities, or more affluent neighborhoods. Whether intentional or not, the result is a negative impact on those communities that may have been adverted with distributive effects analysis.

A summary of all the case studies reviewed is provided in Appendix A.

3.1 State Subsidy to Undergraduate Education

In this study [28], the authors looked at the tax revenues from the state's general revenue funds, local property taxes, and personal property taxes and computed the appropriations to undergraduate education at state and public community colleges as public subsidies. They also included the direct financial aid provided to this sub-population. To calculate the distributive effects, they gathered income distribution information from undergraduate enrollment and financial aid recipients. By applying the income distribution to the public subsidies and financial aid, they were able to get the benefit side distributions. By applying the income distribution to the relevant state and local taxes, they arrived at the cost side distributions. The study then compares the percentage contribution of costs and benefits by each income group and concludes that the existing system of public subsidy to undergraduate education favors lower-income and middle-income groups and that public subsidies lead to redistribution of income from higher-income to lower-income and middle-income families.

3.2 Federal Family Leave Requirements

Two law review articles by Hila Shamir examine the impact of family law, and the Family Medical Leave Act in particular, on women of different incomes and career tracks [29], [30]. Although neither article contains a great deal of the quantitative measures that would allow policy makers to make objective tradeoffs with some precision, they do engage in the type of qualitative examination required of all distributive analyses. Ideally researchers would try to predict these differential effects before a policy was implemented rather than after the fact.

The key question Shamir seeks to answer is whether state intervention in the freedom to contract actually benefits its intended targets. She finds that FMLA benefits family care in two different ways: first by providing family leave benefits to most workers, and second by excluding most family care arrangements from the effect of employment laws, thereby making family care more affordable. She also finds mandating unpaid family leave helps some workers but hurts others.

One finding is that FMLA did not transfer any of the cost of family care onto employers or workers without family responsibilities; the cost of care remains with workers who take the leave. This in turn explains why women take more leave than men; in two-income families where the male earns more, it makes sense for the lowest-paid spouse to take unpaid leave. As a result, the FMLA "does not significantly help the people it aims to benefit—workers with familial care responsibilities, specifically women [29]." Unfortunately, this may compel a reduction in women's labor market participation because their career is interrupted by long periods of leave, thereby decreasing their incentive to invest in the development of human capital. On the other hand, she also finds that generous paid family leave causes employers to segregate labor markets and reduce wages in "feminized" occupations. FMLA also did not affect the distribution of family care responsibilities between men and women.

FMLA does not cover employees who work for an employer less than one-year, part-time workers, and those who work for a small employer. These exclusions primarily affect low-income workers, many of whom are hired by two-income families to provide care for family members. This exclusion makes in-home care more affordable to those who remain in the workforce and strengthens their ties to the workforce, but it disadvantages low-income caregivers who are denied the legal benefits that most workers get. Interestingly, the exclusion of home health care workers from labor laws may increase their wages compared to a situation in which they bore the full costs of obtaining family leave and other benefits.

3.3 Bt Cotton and Indian Farmers

Bt Cotton developed by Monsanto (now Bayer) is the only genetically modified (GM) crop that the government of India has allowed into the country. Bt Cotton made its entry circa 2002 and continues to be a subject of controversy even though more than 90% of cotton grown today in Indian farms is Bt Cotton [31]. Opponents of Bt Cotton contend that the foray of Bt Cotton into India has resulted in a tragic increase in farmer suicides.

This case study presents a number of variables/factors across socioeconomic and cultural dimensions from the perspective of understanding the distributive effects, highlighting points made both by proponents and opponents of the GM seed. The following discussion is not aimed at establishing or denying direct or indirect connections between Bt Cotton and an increase in farmer suicides. Instead, it is only aimed at teasing out some of the important distributive effects of a very complex case.

Prior to the entry of Bt Cotton, most Indian cotton farmers (and Indian farmers in general) were small-to-medium farm owners that had low seed costs and shared the seeds of the previous year's successful harvest amongst themselves without any intellectual property restrictions. They also owned the seeds of the crop they harvested. With the entry of Bt Cotton, the farmers must purchase the seeds annually from Monsanto or their Indian partner seed companies, which by some estimates were an 8000% increase towards seed cost and royalties [32]. Both proponents and opponents acknowledge that GM farming uses more water compared to traditional farming.

One of the main benefits touted by proponents of GM farming is the increased crop yield and therefore presumably greater revenue and income to the farmer than before. Some early reviews, such as the 2008 International Food Policy Research Institute (IFPRI) discussion paper [33], analyzed the average effects of Bt Cotton relative to non-Bt Cotton in terms of yields and net returns based on peer-reviewed studies, and stated that Bt Cotton has significantly increased yields and revenue while decreasing the amount of pesticide costs and number of applications. They show that while the total costs increased, the yields and net returns are much higher. But later studies, such as Gutierrez [31] and articles such as Byravan [34], cast doubt on the gains and go the extent of calling the technology sub-optimal for India, leading to stagnant yields, high input costs, increased insecticide use and low farmer incomes that increase economic distress and contribute to farmer suicides. They also recommend non-GM Indian varieties to improve yield and decrease costs. Opponents also point to the introduction of superweeds and super-pests several years down the road despite initial success with the specifically targeted pests and initial reduction of insecticides. This provokes the question - What timeframe of analysis is appropriate for calculating costs and benefits as well as analyzing distributive effects? It appears that there are fluctuations in favor of and against Bt Cotton in terms of yield, depending on the analysis timeframe.

Predatory private lenders existed even prior to GM crops and in some states provided 80% of the agricultural loans [33]. Proponents of GM crops acknowledge that high-priced inputs like seeds, fertilizers, and pesticides made the sellers of these products the new-age moneylenders. Their high interest rates on loans became a burden on farmers, particularly in those years when cash crops, like cotton, failed. Unfortunately, instead of recognizing the shortage of fair lending facilities to farmers, some governments attributed the crisis to farmers' personal frailty and dependence and advocated programs to instill self-respect and self-reliance among agriculturists [35]. Another issue some concerned scientists and activists point to is that when the farmer goes from being a food crop producer (e.g., rice, wheat, maize, pulses) to a cash crop producer like

cotton, they go from being a net food producer to a net food purchaser [36] and are now forced to buying food for their own livelihood from the retail market at a much higher price. Sainath [36] also comments that being a cash crop producer gives them much less control over pricing and income due to global market forces such as US-EU subsidies and may point to inadequate support from local and central governments to supports farmers.

Finally, proponents and opponents disagree on how farmer suicide data should be collected. While the IFPRI discussion paper [33] and Gilbert [37] rely on the National Crime Records Bureau (NCRB) data, some journalists like Sainath [36], [38], and scientist/activists like Shiva [32], point out that suicide data received by NCRB from the respective states don't count women farmers who commit suicide because traditionally they don't own the land, which is in the name of their husbands. Therefore, these data points are logged as suicides but not as farmer suicides even though the women do most of the farm work. These critics also point out that migrant and farm laborer suicides are not counted as farmer suicides either. Thirdly, the critics also point out that millions of small farmers have quit farming and migrated to cities, many going jobless, because they were muscled out of their profession by larger farmers who may be able to adapt to GM farming much better. Therefore, the critics argue that the adverse impact of this large-scale migration and additional suicides from this sub-population are not captured as farmer suicides. Lastly, to get a much better impression of the adverse impact of Bt Cotton on farmer suicides, the opponents assert that the five biggest states where Bt Cotton dominates contribute to two-thirds of the farmer suicides despite having one-third of the population [36]. The rate of farmer suicide in these states is far higher than suicide rates among non-farmers. Moreover, the number of farmers taking their lives is rising even as the number of farmers diminishes. Figure 2 depict the distributive effects from the introduction of Bt cotton in India.

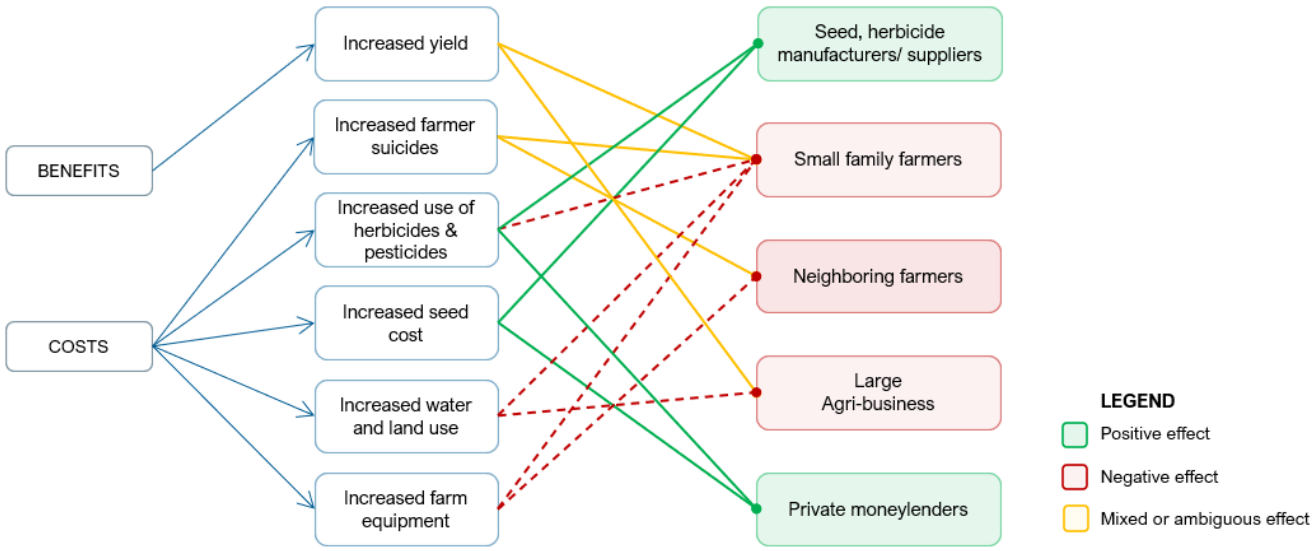

Figure 2. Distributional Effects of BT Cotton and Indian Farmers

3.4 Highway Infrastructure in the Netherlands

In addition to the historical neighborhood impacts of highways previously described, another mechanism for distributive impacts are spillover effects of new highway links, as measured in reduced travel time, which lead to monetized benefits. The geographic nature of transportation means that communities, with origins and destinations dispersed along a transportation network, will receive differentiated benefits. In Condeço-Melhorado *et. al.* [39], the authors focus on the spillover impacts of two highway sections planned in the Dutch province of Noord-Brabant, a region with traffic congestion problems. The study used origin-destination data to conduct an analysis of estimated reduced travel times that would be provided by the new highway segments as compared to the reference scenario, which represents the current road network. The new road infrastructure will be financed mainly by the national government, the province, and the urban region of Eindhoven. However, the study shows that the neighboring province of Limburg will benefit from spillover benefits although this province would not contribute financially to the road construction. depicts the distributional effects of the new highway infrastructure. Figure 3 depicts the distributional effects of the new highway infrastructure. The consideration of spillover and network effects could help planners better align financing of new transportation facilities with those who benefit. In the U.S., this information could inform appropriate finance tiers (federal, state, local), as well as the degree of private vs. public funding, for transportation facilities and other sectors. Use of census track data could facilitate a detailed analysis of subpopulation impacts.

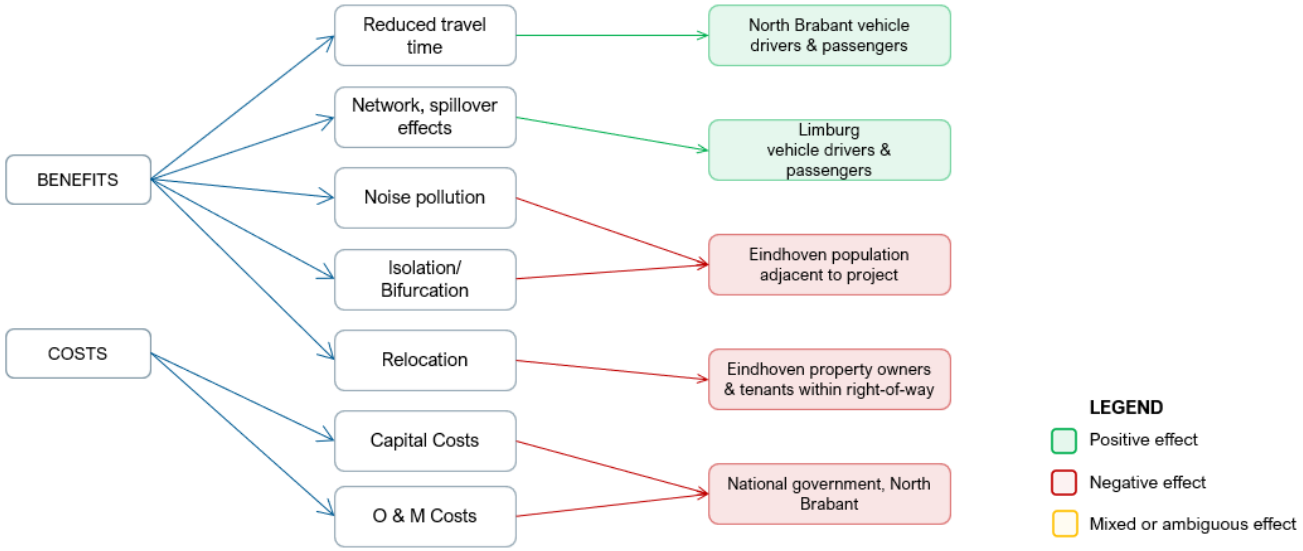

Figure 3. Distributional Effects of Highway Infrastructure in the Netherlands

3.5 Public Transportation Policy in Madrid

This case study uses econometric techniques to measure distributive impact. It considers the policy of subsidizing public transportation fares for young users (ages 23 to 26 years). Using data from the Household Budget Survey (HBS) before (2014) and after (2016) the reduced price for the young travel pass, households affected by the measure (treatment group) were compared to those not affected by it (control group). The control group includes households that spend a minimum of 240€ per year on the travel pass (20€ per month) without benefitting from the young travel pass. The treatment group includes households that spend a minimum of 20€ per month on the travel pass with at least one-member benefitting from the young travel pass.

An econometric model is estimated using impact evaluation (IE) techniques known as Difference in Differences or Double Differences (DID) to evaluate the impact of the change in the young travel pass fare on the household's expenditure on travel passes (dependent variable); this impact has implications on individual welfare. To know the distributional implications of this impact, they repeated the DID estimations by quintiles to test it by social income groups. The IE techniques seek to answer a specific cause and effect question: what is the impact of the reduction in young travel pass fares on Madrid households that spend a minimum of 240€ per year in this service?

The results showed that households of medium and high-medium income levels are the main beneficiaries of this measure, which has increased their individual welfare because their PT expenditure has decreased by 42% and 49% respectively. Second, PT has become more accessible to the poorest households. Finally, there is no effect on the richest households and on the low-medium income level households.

3.6 Housing Policy Towards the Rental Sector in Italy

The size and inelasticity of housing consumption within the household budget makes housing costs an important factor in determining economic resources available to cover other household expenditures. Housing affordability has implications beyond equity, enabling greater mobility of the labor force and among younger generations. This case study explores the distributional effects of housing policy towards the rental sector to analyze affordability and housing policy implications for income distribution [40].

The authors assess the impact of three different policy instruments in Italy: social housing, a personal income tax credit for renters, and a housing allowance targeted to low-income households. Analysis used data from the 2006 It-Silc Survey, which contains information on the sociodemographic characteristics (including incomes) of Italian households in 2006. Importantly, the survey includes information on social housing aid. A parallel database from the United States would be the American Housing Survey (AHS). For assessing the impact of the tax credit, tax data was simulated using a tax-benefit microsimulation model.

For the distributional outcomes of each policy instrument, the impact on poverty and income inequality were assessed by computing Gini coefficients in three instances: (1) before housing costs and transfers, (2) after housing costs but before transfers, and (3) after housing costs and transfers.

Results found that the three policy instruments had similar distributive impacts, with a sufficient degree of targeted efficiency towards the lower income distribution, and some benefits towards middle-income households. Table 2 shows the share of households receiving benefits from each policy instrument and the index of vertical expenditure efficiency, which is defined as the share of

each transfer that goes to the poor based on a poverty line computed on incomes before the receipt of the transfers. Additionally, authors found that the social housing policy favored older households while the allowance was concentrated on younger households.

Table 2. Housing Policy Instruments and their Distributive Effects

Policy Instrument	Description	Incidence of receiving transfer benefit		Index of Vertical Expenditure Efficiency
		Renters	All households	
Personal Income Tax Credit	Personal income tax credit on rental spending, imputed rent is deductible from tax.	33.4%	6.1%	44%
Social Housing	Rental housing owned by the public sector, with the aim of providing affordable housing.	20.1%	3.7%	44%
Housing Allowance	Monthly allowance to spend on rental costs to increase affordability of leases in current market.	5.2%	0.9%	61%

4. Summary and Next Steps

Understanding distributional effects can help decision-makers balance the trade-offs between economic efficiency and distributional impacts. Distributive effects analysis supplements BCA and provides information on how the costs and benefits would be distributed. This methodology for analyzing the distributional effects builds upon existing methodologies and their application in literature. Distributional effects analysis should be objective and should not include normative judgments about social equity. The case studies demonstrate that distributional effects are an important consideration across a broad range of sectors including, but not limited to, transportation, health, agriculture, communications, energy, housing, banking and finance, small business, and tax policy. Analyzing the distributional effects after conducting BCA is imperative to understanding the significance of government action on social equity, meaning whether the distribution of benefits and costs is "fair."

BCA can obscure who "wins" and who "loses" by aggregating the benefits and costs of a government action. Furthermore, BCA has a structural bias against low-income populations based on the implicit assumption that the distribution of income in society is equitable, and that the marginal utility of income is equal for all individuals. The economic principle of diminishing marginal utility of income asserts that marginal utility (or satisfaction) of income decreases with increasing wealth. Some countries have accounted for this structural bias in BCA with the application of income weights. HMT recommends using 1.3 as the marginal utility of income for the lowest income individuals, meaning that a redistribution of income to the lowest income individuals can be valued as a 30% gain to social welfare [18]. The Commonwealth of Australia recommends the assignment of distributional weights for income should be a political judgement [21]. Statistics Canada has reported on the advantages and disadvantages various measures for the distribution of income, including indexes [20]. Options for integrating social equity into the

BCA framework when determining federal and state government actions should be investigated further.

The BCA framework could be expanded to address social equity both within BCA and throughout the planning process. The use of indicators, weights, and indexes could be determined through the elicitation of expert opinion and stakeholder engagement with a neutral third-party as the lead organization. This may be specific to a federal agency or apply more generally to the application of BCA across agencies.

Various use cases could be developed for government partners, ideally using proposed government actions that are currently under consideration. A use case that studies an implemented government action could also be helpful for understanding whether the intended outcomes materialized or if unintentional consequences exist.

Acting on these recommendations will make it easier for the federal government to comply with OMB requirements (*Circular A-4*) and six EOs dating back to the Clinton Administration (i.e., EO 12291, EO 12866, EO 13563, EO 13990, EO 13985 and EO 14008) that specify the need for identifying and analyzing the distributional effects in conjunction with BCA and social equity considerations.

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Appendix A. Case Study Summary Table

ID	Title	Description	Source	Author(s)
1	Does Drought Always Cause Economic Loss in Agriculture? An Empirical Investigation on the Distributive Effects of Drought Events in Some Areas of Southern Europe	Uses consumer surplus theory to focus on distributive effects of drought, such as the characteristics, signs, and magnitude of the socioeconomic impacts of droughts on specific agricultural areas in Europe. Some social groups (e.g., some categories of farmers) can "win," while others "lose" (e.g., final consumers).	Science of the Total Environment, Vol. 633 (2018) p. 1560-1570	Dario Musolino, Antonio Massarutto, and Alessandro de Carli
2	Distributive effect of state subsidy to undergraduate education: the case of Illinois	Costs are estimated based on state and local tax share of relevant income groups. Benefits are estimated based on revenue appropriations to state and community colleges, as well as financial aid given to students in different income groups. Study found public subsidies lead to redistribution of income from higher-income to lower-income and middle-income families.	Economics of Education Review, Vol. 18 (1999) p. 213–221	Seong Soo Lee, Rati Ram, Charles W. Smith
3	The Distributive Effects of Education: An Unconditional Quantile Regression Approach	Study uses unconditional quantile and recentered influence function regressions to explore the effects of increased education on unconditional income inequality. Study found education contributed positively to increased inequality in Argentina due mostly to heterogeneous effects of education on earnings.	Revista de Análisis Económico, Vol. 29, No. 1 (2014) p. 53-76	Javier Alejo, Maria Florencia Gabrielli, Walter Sosa-Escudero
4	Balancing the Carbon Budget for Oil: The Distributive Effects of Alternative Policies	Examines the impact of carbon policies on people in regulated and unregulated markets. Considers the effect of three policies: carbon taxes, increasing the size of the regulated region, and improving the performance of clean technologies. Study supports a global carbon dioxide tax.	European Economic Review, Vol. 99 (2017) p. 191-215	Carolyn Fischer and Stephen W. Salant

ID	Title	Description	Source	Author(s)
5	Regional Net Impacts and Social Distribution Effects of Promoting Renewable Energies in Germany	Multiregional price and quantity input-output models with endogenous heterogeneous households are used to trace the indirect impacts of the Renewable Energy Sources Act (EEG) on value added and disposable income through the complex network of regional value chains. Findings suggest renewable energy leads to small positive impacts on industries and significant impact on household income.	Ecological Economics, Vol. 135 (2017) p. 195-208	Johannes Többen
6	The Vertical and Horizontal Distributive Effects of Energy Taxes: A Case Study of French Policy	Uses a microsimulation of consumer surveys to measure the elasticity of energy use for transportation and housing in response to French energy taxes. Douenne then measures both horizontal and vertical incidence using alternative policies for redistributing the tax revenue. He finds significant differences among certain low-income households even when vertical effects are minor.	The Energy Journal, Vol. 41, No. 3 (2020)	Thomas Douenne
7	The welfare effects and the distributive impact of carbon taxation on Italian households	This study calculates the welfare effects and the distributive effects on Italian households of the Italian Carbon tax. Its welfare effects have been calculated using True Cost of Living index numbers and the Compensating Variation. The parameters have been obtained through estimation of a complete Almost Ideal demand system. Evidence suggests the use of carbon taxes, at least in the transportation sector.	Energy Policy, Vol. 33 (2005) p. 1597-1612	Silvia Tiezzi
8	On Distributive Effects of Optimal Regulation of Power Grid Expansion	Uses a Hogan-Rosellon-Vogelsang mechanism to measure the optimum regulation of a constrained electric grid. The choice of Laspeyres or ideal weights depends upon whether the regulator wishes to favor the transmission company or the consumers.	Energy Policy, Vol. 69 (2014) p. 189-204	Louis Angel Herrara and Juan Rosellon

ID	Title	Description	Source	Author(s)
9	The impact of phasing out fossil fuel subsidies on the low-carbon transition	Used an EIRIN Stock-Flow Consistent behavioral model to study the gradual phasing out of fossil fuel subsidies and the effect on growth, employment, credit and the bonds market, as well as distributive effects across heterogeneous households and sectors. Study found that reforming fossil fuel subsidies in high-income countries could create the conditions to foster a stable low-carbon energy transition, with positive socioeconomic effects.	Energy Policy, Vol. 124 (2019) p. 355-370	Irene Monasterolo, Marco Raberto
10	Private Pensions – A viable alternative? Their distributive effects in a comparative perspective	This paper explores the distributive effects of private pensions on the basis of Luxembourg Income Study microdata for 12 industrialized welfare states. While confirming that private pensions indeed tend to produce specific inequalities, the results also emphasize the importance of policy factors in mitigating the distributive effects.	International Social Security Review, Vol. 53, No. 3 (2000)	Christina Behrendt
11	Housing Policy Towards the Rental Sector in Italy: A Distributive Assessment	Study of the distributive effects on Italian households of three housing subsidies targeted at renters. Results show these schemes target low-income households well, but have a very limited effect on social protection, with the partial exception of social housing.	Housing Studies, Vol. 27, No. 5 (2012) p. 563-581	Massimo Baldini and Teresio Poggio
12	Connecting the periphery: distributive effects of new infrastructure	Ex-post analyses exploring whether employment and population were redistributed following the opening of a tunnel. Distinguishes between distributive accessibility effects and distributive center-periphery effects using OLS regression analyses.	Journal of Transport Geography, Vol. 22 (2012) p. 187-198	Evert Meijers, Joris Hoekstra, Martijn Leijten, Erik Louw, Marjolein Spaans

ID	Title	Description	Source	Author(s)
13	Infrastructure and Economic Growth in Asia	Each chapter uses a common model to analyze the distributive effects. The approach combines a dynamic computable general equilibrium (CGE) model – which captures macro impacts as well as changes in prices, factor returns, and employment – with a microsimulation analysis that maps these impacts to individual and household-level decisions and resulting incomes. Its focus is to measure the impact on poverty.	Economic Studies in Inequality, Social Exclusion, and Well-Being	John Cockburn, Yazid Dissou, Jean Yves Duclos, and Luca Tiberti, editors
14	Sorting over Flood Risk and Implications for Policy Reform	Looks at housing data in Florida to estimate the distributional consequences of federal disaster policy, including flood insurance. It finds that low income and minority residents are more likely to move into high-risk flood zones. It also looks at the effect of alternative policies. The cost of flood insurance falls more heavily on low-income residents.	Journal of Environmental Economics and Management, Vol. 104 (2020)	Laura Backkensen and Lala Ma
15	The Distributive Effects of IP Registration	Registering IP rights yields significant advantages, but it also imposes significant costs, which in turn, may create distributive effects by hindering some more than others. Found that acknowledging IP rights without registration can be a more egalitarian way of protecting innovation and creativity.	Stanford Technology Law Review, Vol. 23, No. 2 (2020) p. 306-374	Miriam Marcowitz-Bitton and Emily Michiko Morris
16	Norms and monetary fines as deterrents, and distributive effects	Study considers a model of deterrence in an economy with heterogeneous individuals. The model enables the analysis of the difference between norms and fines in terms of the identities of those who commit socially undesirable acts.	Journal of Economics, Vol. 121 (2017) p. 1-27	Kangoh Lee

ID	Title	Description	Source	Author(s)
17	Between Home and Work: Assessing the Distributive Effects of Employment Law in Markets of Care	This study looks at the distributional effects of federal labor law on different groups including women, men, those with low incomes, those with families, and care givers. The discussion is qualitative, and the author does not refer to the specific data findings of any quantitative work.	Berkeley Journal of Employment and Labor Law, Vol. 30, No. 2 (2009)	Hila Shamir
18	The Distributive and Welfare Effects of Product and Labour Market Regulation	Study shows that deregulation in the labor goods market has mixed results on inequality. Although deregulation benefits most, it hurts some unionized workers who are in markets with restricted competition.	Labour Economics, Vol. 18 (2011) p. 205-217	Gabriele Cardullo
19	The State of Care: Rethinking the Distributive Effects of Familial Care Policies in Liberal Welfare States	Takes a qualitative look at the effect of labor and welfare laws on diverse populations including middle- and upper-class women, low-income women, care givers, and immigrants. Study evaluates to what extent welfare laws encourage women to be in the labor force, provide good jobs for care givers, encourage women to care for their own children rather than use day care, etc.	American Journal of Comparative Law, Vol. 58, No. 4 (2010) p. 953-986	Hila Shamir
20	European Unemployment Insurance: Economic Stability without Major Redistribution of Household Incomes	Outlines the macroeconomic stabilization effects of introducing a common Pan-Euro area unemployment insurance. Study found the distributive effects on households would be marginal; effects on income distribution would generally be slightly progressive to neutral.	DIW Economic Bulletin (2014)	Ferdinand Fichtner and Peter Haan
21	Labor-intensive firms are a catalyst for monetary policy and its distributive effects	Study of the distributive effects of monetary policy in EU on labor costs and value added. Found a distributive effect between workers and shareholders. Found labor costs in labor-intensive firms decrease more strongly than other firms in response to interest rate increases.	DIW Weekly Report, German Institute of Economic Research	Jan Philipp Fritsche

ID	Title	Description	Source	Author(s)
22	Who Bears the Pain? How the costs of Brexit would be distributed across income groups	Analyzes the distributional effects of Brexit across different income groups and types of households. Study discusses potential impacts through reduced EU immigration and changes in skill demands. Authors use the same "computable general equilibrium" model of the global economy developed by Dhingra et al (2016a) to study the consequences of Brexit but focus on the impact across different income groups.	Centre for Economic Performance, London School of Economics and Political Science	Holger Breinlich, Swati Dhingra, Thomas Sampson and John Van Reenen
23	The distributive effect of monetary policy: The top one percent makes the difference	The examination of the distributional effects of monetary policy is implemented through multiple time series analyses. As an inequality measure, Gini index is used because it provides the broadest coverage across time. The study found that tightening of monetary policy decreased income inequality.	Economic Modelling, Vol. 65 (2017) p. 106-118	Karen Davtyan
24	The Distributive Effects of Indirect Taxation: An Econometric Model and Empirical Results Based on Norwegian Data	The paper describes an econometric model for analyzing the distributive effects of changes in indirect taxation and reports some results regarding Norwegian excise taxes and subsidies.	Swedish Journal of Economics, Vol. 77, No. 1 (1975) p. 1-12	Erik Biorn
25	Distributive Effects of the Reform of Value-Added Tax (VAT)	Used AIDS model and Belgian National Accounts data to evaluate the distributive effects of VAT reforms. Study found the Belgian VAT system to be slightly progressive if vertical equity is defined in terms of consumption and regressive if vertical equity is defined in terms of disposable income.	University of Liege	Bernard Thiry

ID	Title	Description	Source	Author(s)
26	Tourism and income distribution: Evidence from a developed regional economy	The ways in which tourism consumption affects income distribution involves three channels: changes in prices, earnings of households, and government revenues. The authors focus their analysis on the latter two channels through a social accounting matrix (SAM) model of Galicia, Spain, for the year 2008. Results found positive effects on all income groups; however, high-income households benefit more than low-income ones.	Tourism Management, Vol. 48 (2015) p. 11-20	Andre Carrascal Incera, Melchor Fernandez
27	Subsidisation of Public Transport Fares for the Young: An impact evaluation analysis for the Madrid Metropolitan Area	Econometric model using impact evaluation (IE) techniques as Differences in Differences or Double Differences (DID) to evaluate the impact of the change in the young travel pass fare on household cost before (2014) and after (2016) policy was implemented. Results showed at first, households of medium and high-medium income levels are the main beneficiaries of this measure and second, transport has become more accessible to the poorest households.	Transport Policy, Vol. 74 (2019) p. 84-94	José M. Arranz, Mercedes Burguillo, Jennifer Rubio
28	Distributive effects of new highway infrastructure in the Netherlands: the role of network effects and spatial spillovers	In this study, the authors focus on the spillover impacts of two highway sections planned in Eindhoven, a region with traffic congestion problems. The new road infrastructure will be financed mainly by national government, the province, and the urban region of Eindhoven. Study found the network effects and spatial spillover effects entail a redistribution of impacts among regions, which may be causing systematic underestimation of profitability of transport projects and the public financing they require.	Journal of Transport Geography, Vol. 34 (2014) p. 96-105	Ana Condeço-Melhorado, Taede Tillema, Tom de Jong, Rogier Koopal

ID	Title	Description	Source	Author(s)
29	Assessing the Distributive Effects of Minimum Wage	Uses wage and hours data to look at the effects of doubling the minimum wage in Uruguay. Found the effectiveness of the policy depends on the employment effect. Policy led to a reduction of hours outside of the capital city. Wages in the informal sector also rose.	Review of Development Economics, Vol. 21 (2017) p. 1081-1112	Fernando Borraz and Nicolas Gonzalez-Pampillon
30	Income Distributive Effects in the Brazilian Economy	Created an input-output model where the sectoral income values vary according to the proportions of the autonomous demand, including the income distribution structure per income group and per type of value-added. Study found the concentration income tendency benefiting income groups whose earnings come from capital.	Economic Systems Research, Vol. 13, No. 3 (2001)	Jose Euclides A. Cavalcanti