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ABSTRACT

Federal agencies must conduct regulatory analysis on potential rules to make sure that they work for the benefit of the public. When doing this, agencies conduct cost-benefit analysis (CBA) on a rule individually. This 'piecemeal' approach holds other rules in the regulatory environment fixed. But an agency's ability to pass multiple rules means the regulatory environment is not otherwise fixed. Rules can have 'positive interdependencies,' whereby one rule can increase the effectiveness of another rule. They can also have 'negative interdependencies,' whereby one rule can decrease the effectiveness of another rule. Large numbers of rules can also display 'macro-interdependencies.' In a world where agencies pass large numbers of rules, interdependencies between rules often confound the validity of individual CBA estimates. In such

situations, current CBA practices lead to improper rule promulgation and review, a problem that we term 'interdependency error,' and which is pervasive in U.S. agency rulemaking. While agencies have begun to consider interdependencies between rules, this analysis remains at a nascent stage and does not fully account for the issues newly identified in this paper. Nonetheless, the consideration of how to prudently incorporate rule interdependencies into multiple-rule analysis presents theoretical difficulties. This paper provides support for a Multiple-Rule Cost-Benefit Analysis (MCBA) approach and provides principles and tools that an agency can use when implementing, removing, updating, or replacing a rule. MCBA is compared to current trends towards regulatory budgets and retrospective review; Multiple-Rule Cost-Benefit Analysis extends retrospective review and offers a superior means to address the concerns of regulatory budgeting proponents.

INTRODUCTION

Current law requires federal agencies to use cost-benefit analysis (CBA) to analyze proposed and existing rules that have a major impact on society.[1] This requirement aims to ensure that the increasing volume of federal regulation works to benefit the American people.[2] For the last three decades, academics have hotly debated the usefulness and consequences of CBA.[3] Despite

1. *See* Exec. Order No. 12,866, 3 C.F.R. 190 (1994) [hereinafter Exec. Order No. 12,866] (requiring that the benefits of both new and existing regulations exceed their costs. "The objectives of this Executive order are to enhance planning and coordination with respect to both new and existing regulations.").

2. *Id*. ("The American people deserve a regulatory system that works for them, not against them . . . [w]ith this Executive order, the Federal Government begins a program to reform and make more efficient the regulatory process.").

3. For a small sampling of issues, *see, e.g.*, Michael S. Baram, *Cost-Benefit Analysis: An Inadequate Basis for Health, Safety, and Environmental Regulatory Analysis*, 8 ECOLOGY L.Q. 143 (1980) (reviewing and criticizing the methodological weaknesses in conducting cost-benefit analysis); Matthew D. Adler & Eric A. Posner, Introduction, 29 J. LEGAL STUD. 837, 839–41 (2000) (noting that, under a government driven entirely by public choice factors, it is hard to imagine a normative argument in favor of cost-benefit analysis); Eric A. Posner, *Cost-Benefit Analysis as a Solution to a Principal-Agent Problem*, 53 ADMIN L. REV. 289, 291 (2001) (discussing cost-benefit analysis as a device for

these debates, CBA has become an increasingly important part of rulemaking, and agencies are usually unwilling to promote an economically significant rule that does not yield a positive CBA estimate.[4]

Yet CBA, in analyzing one rule at a time, fails to see the forest for the trees. In its current form, agency CBA leads to serious systematic error that has until now been under-analyzed in the literature. Contrary to the CBA directive to compare individual rules to a baseline, rules do not exist in a vacuum; their effects interact with each other in a complex web of interdependencies. We term these either 'negative interdependencies,' where the passage of one rule reduces the efficacy of another, or 'positive interdependencies,' where the passage of one rule increases the efficacy of another. As perhaps the clearest example, alternatives to rules can be conceptualized as rules with strong negative interdependencies: implementing one rule almost entirely negates the benefits of the second rule,

reducing moral hazard); Henry S. Richardson, *The Stupidity of the Cost-Benefit Standard*, 29 J. LEGAL STUD. 971, 972–73 (2000) (arguing that cost-benefit analysis's "underlying normative standard of choice makes no room for intelligent deliberation about how best to use our resources"); Lisa Heinzerling, *Regulatory Costs of Mythic Proportions*, 107 YALE L. J. 1981, 2042–64 (1998) (noting flaws with cost-benefit analysis, such as an improper discounting of future lives and the lack of quantifiability of many risks and benefits); David Copp, *The Justice and Rationale of Cost-Benefit Analysis*, 23 THEORY & DECISIONS 65, 74–77 (1987) (arguing that cost-benefit analysis incorporates an unacceptable principle of justice, giving greater weight to the welfare of better-off members of society than the welfare of the poor); Eric A. Posner & Matthew D. Adler, *Rethinking Cost-Benefit Analysis* 109 YALE L. J. 165, 167–68 (1999) (defending CBA as a decision procedure rather than a moral guideline that produces effective results when used under the right framework and falls in line with popular theories of governance.); U.S. GENERAL ACCOUNTING OFF., GAO/RCED-84-62, COST BENEFIT ANALYSIS CAN BE USEFUL IN ASSESSING ENVIRONMENTAL REGULATIONS DESPITE LIMITATIONS (1984); U.S. GENERAL ACCOUNTING OFF., GAO/RCED-98-142, REGULATORY REFORM: AGENCIES COULD IMPROVE DEVELOPMENT, DOCUMENTING, AND CLARITY OF REGULATORY ECONOMIC ANALYSES (1998).

4. Since, in some cases, agencies are legally required to conduct CBA, *see* Corrosion Proof Fittings v. EPA, 947 F.2d 1201 (5th Cir. 1991), they are generally unwilling to disregard a CBA estimate unless there are significant unquantifiable benefits or costs. *See*, *e.g.*, See Federal Motor Vehicle Safety Standard, Rearview Mirrors; Federal Motor Vehicle Safety Standard, Low-Speed Vehicles Phase-In Reporting Requirements, 75 Fed. Reg. 76,238, 76187 (Dec. 7, 2010) (to be codified at 49 C.F.R. pts. 571, 585).

since both alternatives carry out the same purpose. The reductionist practice of producing a single CBA estimate of each rule, relative to one or a few baselines, fails to capture these interdependencies and leaves the methodology open to both error and manipulation. We call the resulting errors 'interdependency error.' While this flaw is potentially fatal for CBA,[5] we argue in this paper that there are workarounds that can effectively save CBA.

Interdependency error is pervasive and potentially damning for the practice of CBA. In part, this is a matter of regulatory output: the number of regulations and rules has continually risen in the last 40 years.[6] The EPA, for example, has over 170,000 "regulatory restrictions."[7] Despite recent policy developments in the Executive Branch, this number will most likely continue to increase in the coming years.[8] We believe that it likely that the damage or foregone benefits from interdependency error adds up to the billions, with profound effects on jobs, the economy, and the environment. The expansion of regulations, where excessive, can cause the loss of hundreds of thousands of jobs, economic

5. *See* Matthew C. Turk, *Overlapping Legal Rules in Financial Regulation* 54 GA. L. REV. 791, 856 (2020) ("The failure to factor in overlap leads the standard CBA procedures astray because it means that they overestimate the benefits of regulatory substitutes (which crowd each other out) and underestimate the benefits of regulatory complements (which amplify one another).").

6. *See* COLUMBIAN COLLEGE OF ARTS AND SCIENCES, *Reg Stats*, *available at* https://regulatorystudies.columbian.gwu.edu/reg-stats (Showing less than 30 economically significant final rules published each year before 1990, around 40 economically significant final rules published each year between 1990 and 2010 and more than 50 significant final rules published per year between 2011 and 2016. 2017 had the fewest economically significant final rules published per year since 1987. The total pages published in the Code of federal Regulations has also increased from a minimum of 10,000 pages in 1950 to a maximum of over 180,000 pages by 2016.)

7. *See* QUANTGOV, Federal Regulation Tracker, *available at* https://quantgov.org/federal_regulation_tracker (showing over 170k regulations when "Select Agencies" is set to "Environmental Protection Agency").

8. *See* Exec. Order No. 13,771, 82 Fed. Reg. 9339 § 1 (2017) [hereinafter Exec. Order No. 13,771] ("Unless prohibited by law, whenever an executive department or agency (agency) publicly proposes for notice and comment or otherwise promulgates a new regulation, it shall identify at least two existing regulations to be repealed.").

inefficiency, and the destruction of capital stock.[9] In the meanwhile, piecemeal CBA might be missing billions of dollars of improvements from positive interactive effects between regulations. Note that, over the ten years from Fiscal Year 2006 to Fiscal Year 2016,[10] annualized benefits and costs of major federal government rules ranged from $302 to $930 billion and $88 to $128 billion respectively.[11] Since interdependencies can significantly affect the CBA estimate of any particular rule—in some cases of negative interdependency, less than half of the expected benefits materialized[12]—it is likely that accounting for interdependency error will change the allocation of billions of those dollars. In one of the examples we discuss, it was estimated that one rule reduced the net benefits of another by as much as $77 billion.[13] To add to this, Cass Sunstein has argued that just a few cases of retrospective review of agency rules has led to savings of around $10 billion over five years.[14] If even a fraction of the savings from retrospective review are driven by changes in the *regulatory environment*, then accounting for interdependencies ex ante can derive benefits on a similar scale, sooner than retrospective review does, and at relatively low additional procedural burden.

Astonishingly, despite the obvious effects of interdependencies, there is little academic or policy-maker discussion of the topic. In the academic world, we were able to find only one paper that engaged in more than cursory analysis

9. *See*, *e.g.*, Dustin Chambers et al., *How Do Federal Regulations Affect Consumer Prices? An Analysis of the Regressive Effects of Regulation*, 180 PUB. CHOICE (2019) (finding that regulations led to consumer price increases). *See also* James B. Bailey & Diana W. Thomas, *Regulating Away Competition: The Effect of Regulation on Entrepreneurship and Employment*, 52 J. REG. ECON. 237 (2017).

10. We choose this time period because it predates the implementation of the "One In, Two Out" rule implemented in Exec. Order No. 13,771.

11. *See* OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, 2017 DRAFT REPORT TO CONGRESS ON THE BENEFITS AND COSTS OF FEDERAL REGULATIONS AND AGENCY COMPLIANCE WITH THE UNFUNDED MANDATES REFORM ACT 101, https://www.whitehouse.gov/wp-content/uploads/2017/12/draft_2017_cost_benefit_report.pdf.

12. *See* Cohen & Keiser, *infra* note 131, at 36.

13. *See infra* notes 130–132 and accompanying text.

14. *See* CASS R. SUNSTEIN, SIMPLER: THE FUTURE OF GOVERNMENT (2013).

of interactive effects between regulations.[15] Even then, this was an incomplete analysis and was not framed in the language of CBA.[16] There have recently been executive branch concerns about the "cumulative effects" of regulations, but this discussion focuses mostly on the practical effects of the aggregate costs of excessive regulation, without a detailed framework, neglecting the effects on CBA practices, and ignoring positive interdependencies through costs, or interdependencies in benefits.[17] What agency guidance exists lays out rudimentary but ultimately unsatisfactory directions for `combining' rules with similar effects.[18] To our knowledge, despite the prevalence of interdependency between rules, nothing in the literature provides an analytical framework for understanding interdependencies and their relation to CBA.

However, we claim in this Article that the problem of interdependency error need not be fatal to CBA. This Article proposes that agencies should account for interdependencies systematically. Agencies should carry out Multiple-Rule Cost-Benefit Analysis, where we define Multiple-Rule Cost-Benefit Analysis to be the explicit analysis of cost and benefit interdependencies between rules, at a systematic level, by an agency. Agency use of MCBA methods would greatly reduce errors and the potential for manipulation of rulemaking processes. Explicit accounting for interdependencies also does better than other recent alternatives proposed out of a worry about the aggregate effects of rules, such as regulatory budgeting like One-In Two-Out.[19] We are worried about the ideological, purely deregulatory bent of such solutions, and in that sense propose MCBA as a less ideological method that nonetheless addresses real concerns about cumulative cost. We lay out and defend principles that we believe MCBA should conform to, and then outline tools and heuristics that would be relatively cheap for agencies to consider and would greatly improve an agency's

15. *See infra* note 96.

16. *See infra* note 97.

17. We compare "cumulative effects" to our framework in *infra* Part I.D and Part II.C.4.

18. *See infra* Part II.C.1.

19. For a discussion of regulatory budgets, *see infra* Part III.E.

decision-making.

This Article proceeds as follows. Part I examines the history of CBA requirements over the last four decades and explains how it is performed today. Part II examines interdependencies, provides evidence that they are pervasive, and examines whether agencies consider them enough. Legal support for agency consideration of interdependencies is discussed. Part III discusses the need for a deliberate approach, and thus introduces and defends MCBA as a stand-alone procedure or supplement to traditional CBA. Principles and tools for agency procedure are discussed.

PART I. THE RISE OF COST-BENEFIT ANALYSIS

Cost-benefit analysis is a cornerstone of regulatory process in the United States.[20] At its simplest level, CBA (also called benefit-cost analysis) is a tool to determine a regulation's financial costs and benefits to society, assessed for each regulation individually, relative to one or at most a couple of baselines. This calculation includes the indirect and direct costs and benefits of the regulation. Decision makers use CBA as one of many tools to determine whether to implement a regulation, but CBA is especially important because of the importance placed upon it by policymakers and the public.[21] Cost-benefit analysis is also important because agencies use it to compare multiple regulatory alternatives and select the most effective one. This section evaluates CBA's legal mandate, its role in evaluating current and prospective regulations, and current guidance regarding its implementation.

A. Legal Foundations of CBA and Regulatory Analysis

The requirement to conduct CBA grew out of the public concern that federal regulations were negatively impacting American society. In the 1960s and early 1970s, environmental damage and social concerns fueled public support for increasing

20. *See generally* CASS R. SUNSTEIN, THE COST-BENEFIT STATE: THE FUTURE OF REGULATORY PROTECTION (2002).

21. *Id*.

amounts of federal regulation.[22] However, as these regulations imposed additional costs on the American economy, public attention began to focus on the negative economic and industrial impact of increasing levels of federal regulation. This led to bipartisan support for analytical checks on regulation. In 1974, President Ford required that federal agencies prepare inflationary impact statements to accompany all new major regulations.[23] In 1978, President Carter required federal agencies to conduct regulatory analysis on all new major regulations that have an impact of $100 million or more on the economy.[24] These requirements prepared the groundwork for the beginning of modern regulatory analysis, which includes producing a problem statement, considering alternative solutions, considering economic impact, and justifying the final choice of rule.[25]

On February 17, 1981, President Reagan institutionalized cost-benefit analysis through Executive Order 12,291.[26] Executive Order 12,291 aimed to reduce the economic burden of regulation on the economy by increasing the scrutiny that agency regulations must endure.[27] In this initial version of CBA, Reagan required that "regulatory action shall not be undertaken unless the potential benefits to society from the regulation outweigh the potential costs to society."[28] The executive order applies to all regulation that causes an impact to the economy greater than

22. *Reagan Orders Cost-Benefit Analysis of Regulations, Confers Broad Powers on OMB and Regulatory Task Force*, 11 ENV. L. REP. 10044 (1981), https://elr.info/sites/default/files/articles/11.10044.htm.

23. Exec. Order No. 11,821, 3 C.F.R. 203 (1971–1975), [hereinafter Exec. Order No. 11,821] *available at* https://www.govinfo.gov/content/pkg/FR-1974-11-29/pdf/FR-1974-11-29.pdf (requiring that agencies produce an inflationary impact statement to accompany major regulations). Extended by Exec. Order No. 11,949, 3 C.F.R. 161 (1977), [hereinafter Exec. Order No. 11,949] *available at* https://www.govinfo.gov/content/pkg/FR-1977-01-05/pdf/FR-1977-01-05.pdf (requiring the filing of an economic impact statement rather than an inflationary impact statement).

24. Exec. Order No. 12,044, 3 C.F.R. 671 § 3(b)(1) (1978) [hereinafter Exec. Order No. 12,044] *available at* http://www.thecre.com/pdf/12044.PDF.

25. *Id.*

26. Exec. Order No 12,291, 3 C.F.R. 127 (1982), [hereinafter Exec. Order No. 12,291] *available at* https://www.archives.gov/federal-register/codification/executive-order/12291.html.

27. *Id.*

28. *Id.* at § 2(b).

$100 million, major price increases, or significant adverse effects on competition, innovation, employment, productivity, or investment.[29] Any rule where the required analysis was in question would have its requirements determined by the Office of Management and Budget and the President's Task Force.[30] Executive Order 12,291 also requires that regulatory impact analyses include:

(1) the potential quantitative and qualitative benefits of the rule and who receives them;

(2) the potential quantitative and qualitative costs of the rule and who bears them;

(3) the potential net benefits of the rule including the qualitative net benefits;

(4) alternative approaches that could achieve the same regulatory goal at lower cost, together with an analysis of this potential benefit and costs and a brief explanation of the legal reasons why such alternatives, if proposed, could not be adopted;

(5) and a justification for the rule if it does not contain a net benefit.[31]

The requirement that all new major rulemaking contain a net benefit placed significant restrictions on federal agency action. This especially limited rulemaking in situations where the benefits were difficult to quantify and therefore could not mathematically overcome a regulation's costs.

In 1993, President Clinton's Executive Order 12,866 answered the concern that not all costs and benefits can be easily quantified and therefore important regulations could not be created. Executive Order 12,866 changed the CBA standard by requiring that agencies "propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs."[32] Thus, regulations no longer needed to have quantifiably greater benefits than costs. The first executive admission that rules could have interdependent effects came in Executive Order 12,866, which requires that agencies

29. *Id*. at § 1(b).
30. *Id*. at § 3(e)(1).
31. *Id*. at § 3(d).
32. Exec. Order No. 12,866 at § 1(b)(6).

"tak[e] into account, among other things, and to the extent practicable, the costs of cumulative regulations."[33] Otherwise, the order generally matched Executive Order 12,291's definition for a significant action[34] and continued to require an analysis of cost, benefit, and an examination of alternatives.[35]

CBA procedures grew more sophisticated when President Bush expanded Executive Order 12,866 through Executive Order 13,422 in three ways. First, Executive Order 13,422 requires that agencies submit explanations of why they are regulating to OMB before issuing significant agency guidance, defined as guidance documents that will have an annual effect of greater than $100 million.[36] This prevents agencies from implementing unchecked guidance documents rather than going through the more burdensome rulemaking process. Second, agencies have to explain in writing why they are regulating and provide the annual aggregate costs and benefits of their regulatory activity.[37] Finally, the executive order requires that agencies designate a presidential appointee as a regulatory policy officer who has to approve regulations.[38] These changes are still in effect and modified but did not broadly change the mandate set out by President Clinton.[39] Despite this, there was little to account for

33. *Id.* at § 1 (b)(11). This was addressed again by OIRA in guidance put out in 2012. *See* Sunstein Memorandum, *infra* note 86.

34. *Id.* at § 3(f) (categorizing regulatory actions as significant if they (1) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (2) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive order).

35. *Id.*

36. See Exec. Order No. 13,422, 72 Fed. Reg. 2763 (2007, § 1(h) (2007), *available at* https://www.govinfo.gov/content/pkg/WCPD-2007-01-22/pdf/WCPD-2007-01-22-Pg48.pdf.

37. *Id.* at § 4(c).

38. *Id.* at § 5(b).

39. *See* Robert W. Hahn & Robert E. Litan, *Evaluating the New Executive Order on Regulation*, Testimony 07-08: AEI-BROOKINGS JOINT CTR. FOR REG. STUD., (2007), *available at* https://www.brookings.edu/wp-content/uploads/2016/06/200704hahn-1.pdf.; *but see* Curtis W. Copeland, *The Law: Executive Order 13,422: An Expansion of Presidential Influence in the Rulemaking Process,* 37(3) PRES. STUD. Q. 531 (2007) (arguing that Exec. Order

the cumulative or interdependent effects of regulations.

President Obama generally reaffirmed President Clinton's Executive Order 12,866 in Executive Order 13,563.[40] Executive Order 13,563 added the requirement that "among other things, and to the extent practicable, the costs of cumulative regulations."[41] Executive Order 13,563 also added the requirement that agencies must "use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible."[42] Executive Order 13,563 also took a more dynamic view of regulation, since it requires that agencies develop plans to periodically review existing significant regulations and to "modify, streamline, expand, or repeal them" accordingly.[43] This process is called retrospective review.[44] While reaffirming President Clinton's Executive Order, Executive Order 13,563 requires increased analytical rigor on the part of agencies when conducting CBA. Moreover, the agency requirements established in Executive Order 13,563 are not static. They are designed to change with time as indicated by the language 'the best available techniques.'[45] Nonetheless, while Executive Order 13,563 was an admission of the potentially changing and cumulative nature of regulations, it failed, as its predecessors did, to truly instruct agencies to be watchful for the ways in which CBA estimates would change in time as a result of other rules.

Most recently, President Trump's Executive Order 13,771 reaffirms the core principles of CBA contained in Clinton's

No. 13,422 creates substantial changes that increases the President's power over rulemaking while acknowledging that the impact will depend on implementation).

40. *See* Exec. Order No. 13,563, 3 C.F.R. 215 §1(c) (2012), *reprinted as amended in* 5 U.S.C. § 601 app. at 103–104 (2014), [hereinafter Exec. Order No. 13,563] *available at* https://www.govinfo.gov/content/pkg/CFR-2012-title3-vol1/pdf/CFR-2012-title3-vol1-eo13563.pdf.

41. *Id.* at § 1(b).

42. *Id.* at § 1(c).

43. *Id.* at § 6.

44. For a deeper discussion into the history of retrospective review and its gradual adoption since the Carter administration, *see* Administrative Conference of the United States, *Administrative Conference Recommendation 2014-5: Retrospective Review of Agency Rules* (Dec. 4, 2014).

45. *See* Exec. Order No. 13,563.

Executive Order 12,866 and the retrospective review requirements of Obama's Executive Order 13,563 while adding new, significant limitations to agency action. Executive Order 13,771 retains the existing components of CBA under Presidents Clinton and Obama including that benefits justify costs rather than exceed them.[46] However, because of a concern that regulations had become too burdensome, it requires that an agency must find two existing rules to be repealed for every regulation it wishes to pass.[47] At the same time, it requires that the year over year increase in the cost of an agency's regulation be less than or equal to zero.[48] While this has significant impact on agency behavior, it ultimately does not change the CBA required at the time of rulemaking from President Obama's time.

President Trump also implemented new, stricter procedures for retrospective review as a part of regulatory analysis. Executive Order 13,777 requires that all agencies develop a Regulation Reform Task Force (RRTF) that analyzes existing rules.[49] The executive order requires the task force to make recommendations regarding rules that agency heads should modify, replace, or repeal.[50] It also puts in place additional categories of rules that agencies must identify and review in order to strengthen regulatory review programs.[51] This order

46. *See* Exec. Order No. 13,771.

47. *Id*. at § 2.

48. *Id*. at § 3(d) ("During the Presidential budget process, the Director shall identify to agencies a total amount of incremental costs that will be allowed for each agency in issuing new regulations and repealing regulations for the next fiscal year. No regulations exceeding the agency's total incremental cost allowance will be permitted in that fiscal year, unless required by law or approved in writing by the Director. The total incremental cost allowance may allow an increase or require a reduction in total regulatory cost."). This is effectively a regulatory budget designed to maintain or reduce regulatory costs. This paper acknowledges that good intent may lie behind this action but sees the ceiling as arbitrary and inefficient relative to alternative approaches.

49. Exec. Order No. 13,777 § 3(d) ("Each Regulatory Reform Task Force shall evaluate existing regulations (as defined in section 4 of Executive Order 13,771) and make recommendations to the agency head regarding their repeal, replacement, or modification, consistent with applicable law.").

50. *Id*.

51. *Id*. at §3(d)(i)–(vi) (requiring that agencies identify rules that (1) eliminate jobs or inhibit job creation, (2) are outdated, unnecessary, or ineffective, (3) have costs that outweigh benefits, (4) create serious

provides muscle to support the continuing review of existing regulation while explicitly supporting Executive Order 13,771,[52] Executive Order 12,866,[53] and Section 6 of Obama's Executive Order 13,563.[54]

In total, the series of executive orders currently in force provide a comprehensive framework through which federal agencies must analyze new and existing regulations. Agencies must state the problem they are attempting to solve, discuss how the proposed regulation will solve that problem, discuss the benefits and the costs of the regulation, demonstrate that the benefits justify the costs, describe the distributional effects of the regulation, examine alternative solutions, and justify the chosen rule. Additionally, agencies must propose two rules that will be repealed while passing new regulation and make sure that the cost of their regulation to private industry has a net increase of zero or less each year. These requirements detail a complex but ultimately piecemeal approach to analyzing regulation that forces increasingly granular examinations of individual regulations at the expense of considering the entire regulatory environment.

Independent agencies are exempt from the CBA requirements under the executive orders but may still have a CBA requirement based on cross-cutting statutes or agency-specific regulatory requirements. Independent agencies are separated from the legal requirements imposed by the President as the head of the Executive Branch. However, statutes such as the Regulatory Flexibility Act (RFA) of 1980[55] or others that

inconsistency or interfere with reform initiatives, (5) are inconsistent with the requirements of Section 515 of the Treasury and Government Appropriations Act 2001 requiring public and transparent data to support regulatory action, or (6) were implemented by Executive Orders that have since been deleted).

52. *See* Exec. Order No. 13,771.

53. *See* Exec. Order No. 12,866.

54. *See* Exec. Order No. 13,563.

55. 5 U.S.C. §§ 601–612 (Supp. IV 1980) (requiring that that all agencies assess the impact of regulations on small entities). Similarly, the National Environmental Protection Act requires that all agencies provide environmental impact statements, and the Paperwork Reduction Act requires agencies to minimize the paperwork burden on individuals and small businesses when collecting information.

provide independent agencies rulemaking authority may require them to conduct some type of regulatory analysis.[56] Additionally, the Securities Exchange Commission, Commodity Futures Trading Commission, the Consumer Financial Protection Bureau, the Federal Deposit Insurance Corporation, and others are required to consider the benefits and costs of their regulations.[57] However, multiple studies show that the limited oversight of these agencies has led them to conduct less rigorous analyses of their regulations than federal agencies under the purview of the White House.[58]

B. Retrospective Review and CBA

Agencies must conduct CBA not only when passing new rules but when evaluating old rules and determining whether to modify, replace, or remove existing regulation. This process of evaluating existing regulation, known as retroactive review, requires CBA in accordance with APA Section 553[59] in order to determine if a rule continues to be effective or useful. Thereby, agencies use CBA when conducting retroactive review in order to

56. *See, e.g.*, Paul R. Verkuil, *A Critical Guide to the Regulatory Flexibility Act,* 2 DUKE L. J. 213 (1982) (discussing the Regulatory Flexibility Act's possible impact on independent agencies' rulemaking process despite their general immunity from Executive Orders).

57. Bus. Roundtable v. SEC, 647 F.3d 1144 (D.C. Cir. 2011) (holding that the Securities and Exchange Commission failed to adequately assess the economic effects of Rule 14a–11, which required that companies subject to the Security Exchange Act's proxy rules to include persons' names nominated by shareholders for election to the board of directors in proxy materials).

58. *See* Sally Katzen, *OIRA at Thirty: Reflections and Recommendations*, 63 ADMIN. L. REV. 103, 110 (2011) ("IRCs do not typically engage in the rigorous economic analysis that has come to be expected for executive branch agencies. In the 2010 OMB Report to Congress, it appears that roughly half of the rules developed by the IRCs over a ten-year period have no information on either costs or benefits, and those that do have very little monetization of benefits or costs." (citing OFFICE OF INFO. & REG. AFFAIRS, OFFICE OF MGMT. & BUDGET, 2010 REPORT TO CONGRESS ON THE BENEFITS AND COSTS OF FEDERAL REGULATIONS AND UNFUNDED MANDATES ON STATE, LOCAL, AND TRIBAL ENTITIES 97–98 (2010)) (parentheticals removed)).

59. Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 34 (1983) [hereinafter *State Farm*] (holding that for the purposes of APA 553, recession or modification of a previously promulgated regulation is subject to the same judicial scrutiny as the agency's initial adoption of its rules).

weigh the current costs and benefits of a regulation and determine its effectiveness.

The Executive Branch has increasingly pushed for more retrospective analysis since the Carter administration. President Carter created Regulatory Analysis Review Groups in order to assess the impact of existing regulation.[60] Later, Reagan's Executive Order 12,291 targeted "existing and future regulations" and required that federal agencies annually develop lists of existing regulations to review each year and apply the same regulatory analysis to existing regulations as proposed regulations.[61] President Clinton increased the White House's supervision of agencies' retrospective analysis by requiring agencies to submit their plans to review significant regulations to the Office of Information and Regulatory Affairs (OIRA).[62] Concerned that agencies were not pursuing this effort seriously enough, in March 1995, President Clinton ordered federal agencies to do a page-by-page review of existing regulations to determine which regulations could be replaced or repealed.[63] President Bush reaffirmed this mandate while attempting to expand the regulatory review process. In 2001, 2002, and 2004, Bush's OIRA solicited public nominations for rules that should be eliminated or changed.[64]

President Obama continued this legacy, ordering agencies to submit a plan to OIRA regarding how they will review their

60. Exec. Order No. 12,044 at § 4.

61. Exec. Order No. 12,291 at § 2.

62. Exec. Order No. 12,866 at § 5.

63. U.S. GENERAL ACCOUNTING OFF., GAO 98-3, REGULATORY REFORM: AGENCIES' EFFORTS TO ELIMINATE AND REVISE RULES YIELD MIXED RESULTS (1997), https://www.gao.gov/assets/230/224730.pdf ("On March 4, 1995, President Clinton sent a memorandum to the heads of departments and agencies describing plans for changing the federal regulatory system because "not all agencies have taken the steps necessary to implement regulatory reform." Among other things, the President directed each agency to conduct a page-by-page review of all its regulations in force and eliminate or revise those that were outdated or in need of reform.").

64. *See* Curtis W. Copeland, *Federal Regulatory Reform: An Overview*, CRS REPORT FOR CONGRESS 28 (2004), https://www.everycrsreport.com/files/20040420_RL32356_0adcbdcf4cf1d9b3cbad37c605d48834afb64fcc.pdf.

existing regulations.[65] However, despite the reaffirmed directive, agencies repealed or modified only a small number of rules relative to the number of rules passed each year.[66] Agencies cited a number of reasons for not pursuing additional efforts to adjust regulations, including lack of funding, lack of interest, and statutes such as the Paperwork Reduction Act that prevented agencies from collecting adequate information to assess rule effectiveness.[67] Ultimately, agencies focused fewer resources on the analysis and adjustment of old regulation than the promulgation of new regulation. This meant that while the law requires ongoing assessments of existing regulation, in practice, agencies made the review of existing regulations a lower priority than preparing analysis for pending regulations.

President Trump's administration acknowledged the lack of resources and incentives that persistently prevent federal agencies from reviewing existing regulation. Executive Order 13,777 created Regulation Reform Task Forces (RRTFs) in order to nominate various rules to be evaluated and potentially modified, repealed, or replaced.[68] Executive Order 13,771's mandate that agencies identify two rules to repeal when proposing a regulation added significance to this requirement by incentivizing agency heads to utilize their RRTFs. The effects of this program have yet to be seen.[69]

The retrospective review requirement provides support for the concept of multiple-rule CBA. Retrospective review

65. *See* Exec. Order No. 13,610, 3 C.F.R. 13,610 (2012) [hereinafter Exec. Order No. 13,610].

66. *See* Connor Raso, *Assessing Regulatory Retrospective Review Under the Obama Administration*, BROOKINGS (June 2017), https://www.brookings.edu/research/assessing-regulatory-retrospective-review-under-the-obama-administration.

67. *Id.*; *see also* U.S. GOV'T ACCOUNTABILITY OFF., GAO 07-791, REEXAMINING REGULATIONS: OPPORTUNITIES EXIST TO IMPROVE EFFECTIVENESS AND TRANSPARENCY OF RETROSPECTIVE REVIEWS 36 (2007), https://www.gao.gov/new.items/d07791.pdf.

68. *See* Exec. Order No. 13,777.

69. *See* Ted Gayer et al., *Evaluating the Trump Administration's Regulatory Reform Program*, BROOKINGS INST. (2017), https://www.brookings.edu/wp-content/uploads/2017/10/evaluatingtrumpregreform_gayerlitanwallach_102017.pdf.

acknowledges the need to continually assess and work to optimize the regulatory environment. The MCBA approach proposed later in this paper provides agencies a way to better understand how new regulations can change existing CBA estimates. This accords with the mandate of the discussed executive orders while providing efficiency gains for agencies.

C. Circular A-4 and Current Agency CBA Procedure

Executive Order 12,866 and Circular A-4[70] primarily govern federal agency's CBA analyses. While Executive Order 12,866 designates situations where CBA must be conducted, Circular A-4 dictates the process that agencies must follow when conducting their analysis. The three key elements of an agency's regulatory analysis are an explanation of the posited causal links, a comparison of the costs and benefits to a baseline standard, and the identification of second and third-order effects.[71] This section focuses on the second and third elements required by Circular A-4.[72] The document's broad regulatory directives support the practice of multiple-rule analysis.

Cost-benefit analysis requires agencies to calculate benefits and costs relative to a specific baseline in order to determine the rule's impacts.[73] This baseline determination is critical to the analysis because it requires agencies to identify what the world looks like in the next five, ten, or even fifty years. In developing this baseline, the circular explicitly states that agencies need to take into account all significant considerations including "the evolution of the market, changes in external factors, *changes in regulations promulgated by the agency or other government entities* and the degree of compliance by regulated entities with

70. *See* OFFICE OF MGMT. & BUDGET, CIRCULAR A-4, REGULATORY ANALYSIS 1 (2003) [hereinafter OMB, CIRCULAR A-4], http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf.

71. *Id.*

72. *See id.*

73. *Id.* at 9 ("You need to measure the benefits and costs of a rule against a baseline. This baseline should be the best assessment of the way the world would look absent the proposed action.").

other regulations."[74] Oftentimes an agency may consider multiple baselines in order to understand the modeler's uncertainty about the status-quo. The circular cites examples of best practices in this regard.[75]

When analyzing the costs and benefits, agencies are required to consider both the direct and indirect effects of the regulation.[76] When measuring benefits and costs, the Circular directs agencies to use market prices, or when those are not available, willingness to pay, willingness to accept, hedonic price equations, and finally stated preference methods, as needed.[77] However, agencies must also consider "ancillary benefits and countervailing risk" and attempt to monetize and quantify those factors in order to develop a more complete picture of the impact of their rule.[78] When more uncertainty surrounds these calculations, agencies are required to use increasingly formal and complex models to understand the uncertainty in their calculations.[79] For many regulations in today's complex, regulatory-rich and information-rich environment, even small impacts can have wide ranging effects.[80] Therefore, agencies should use disciplined models to

74. *Id.* (emphasis added).

75. *Id*. ("EPA's 1998 final PCB disposal rule provides a good example of using different baselines. EPA used several alternative baselines, each reflecting a different interpretation of existing regulatory requirements. In particular, one baseline reflected a literal interpretation of EPA's 1979 rule and another the actual implementation of that rule in the year immediately preceding the 1998 revision. The use of multiple baselines illustrated the substantial effect changes in EPA's implementation policy could have on the cost of a regulatory program. In the years after EPA adopted the 1979 PCB disposal rule, changes in EPA policy–especially allowing the disposal of automobile "shredder fluff" in municipal landfills–reduced the cost of the program by more than $500 million per year.").

76. *See id*. at 3.

77. *Id*. at 12.

78. Circular A-4 defines ancillary benefit and countervailing risk: "[a]n ancillary benefit is a favorable impact of the rule that is typically unrelated or secondary to the statutory purpose of the rulemaking (e.g., reduced refinery emissions due to more stringent fuel economy standards for light trucks) while a countervailing risk is an adverse economic, health, safety, or environmental consequence that occurs due to a rule and is not already accounted for in the direct cost of the rule (e.g., adverse safety impacts from more stringent fuel-economy standards for light trucks)." *Id.* at 15.

79. *Id*.

80. *See*, *e.g.*, Coglianese, Cary, *Measuring Regulatory Performance,*

better understand the impacts of these regulations and how those impacts change as the economic and regulatory environment changes as well.

When either the economic or regulatory environment that the rule will operate within or the rule's impact is uncertain, Circular A-4 requires agencies to conduct analysis with multiple baselines.[81] It may not always be clear which assumptions used in the analysis create significant impacts on the results. In this situation, Circular A-4 directs agencies to run tests with varying assumptions to determine each assumption's impact.[82] This assumption testing determines the assumptions used either in the baseline case or in the rule's posited causal connection. Ultimately, Circular A-4 requires agencies to incorporate their findings into their analysis to inform decision makers.[83]

Circular A-4 can thus be read to require that agencies analyze all scenarios in which rules may interfere with one another in substantial ways. Moreover, they need to incorporate this into their decision making and inform decision makers about their findings. This includes impacts on direct costs and benefits and ancillary benefits and countervailing risks. Moreover, when uncertainty exists, agencies are tasked to use appropriate methods to quantify and understand the impacts of a rule as much as possible. As this Article will now go on to show, we believe that these interactions between rules—which we call interdependencies—are widespread and significantly change rules' impacts. As a result, they must be considered by federal agencies under existing law, executive orders and the guidance of

Evaluating the Impact of Regulation and Regulatory Policy, Expert Paper No. 1, at 9 (Aug. 2012).

81. OMB, CIRCULAR A-4, *supra* note 70, at 25 ("If benefit or cost estimates depend heavily on certain assumptions, you should make those assumptions explicit and carry out sensitivity analyses using plausible alternative assumptions. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible assumptions, you should conduct further analysis to determine which of the alternative assumptions is more appropriate.").

82. *Id*.

83. *Id*. at 23 ("By assessing the sources of uncertainty and the way in which benefit and cost estimates may be affected under plausible assumptions, you can shape your analysis to inform decision makers and the public about the effects and the uncertainties of alternative regulatory actions.").

Circular A-4.

D. Nascent Concerns about Interdependencies: Cumulative Effects

More recently, the executive has shown concern about the cumulative effect of regulations. The first explicit mention of cumulative effects of regulations was in Executive Order 12,866 instructs agencies to "tak[e] into account, among other things, and to the extent practicable, the costs of cumulative regulations."[84] Executive Order 13,563 further emphasizes that "sectors and industries face a significant number of regulatory requirements, some of which may be redundant, inconsistent, or overlapping."[85]

In 2012, in a memorandum (the "Sunstein memorandum") following the executive order and specifically addressing the issue of cumulative effects, the OIRA chief at the time, Cass Sunstein, instructed agencies to engage in a number of measures that consist of elements of what we will term Multiple-Rule Cost-Benefit Analysis.[86] This includes "careful consideration, in the analysis of costs and benefits, of the relationship between new regulations and regulations that are already in effect."[87] In a sense, this is a departure from Executive Order 13,563, since it instructs agencies to look at the relationship between regulations in terms of *benefits* as well as costs. Sunstein also instructed agencies to consider issues of "coordination of timing, content, and requirements of multiple rulemakings that are contemplated for a particular industry or sector, so as to increase net benefits."[88] Sunstein further instructed agencies to engage in the "use of Requests for Information and Advance Notices of

84. *See* Exec. Order No. 13,563 at 3,822; *see also* Exec. Order No. 12,866.

85. *See* Exec. Order No. 13,563.

86. *See* Memorandum from Cass R. Sunstein, Adm'r, OFFICE OF MGMT. & BUDGET, to Heads and Acting Heads of Exec. Dep'ts and Agencies (Mar. 20, 2012) [hereinafter Sunstein Memorandum]. Agencies have expressed support for the memorandum, *see, e.g.*, Statement in Support of OMB Memorandum: Cumulative Effects of Regulations (Mar. 20, 2012). Multiple-Rule Cost-Benefit Analysis will be defined later in this paper. *See infra* Part III.

87. Sunstein Memorandum, *supra* note 86, at 2.

88. *Id.*

Proposed Rulemaking to obtain public input on potentially overlapping rulemakings and on rulemakings that may have significant cumulative effects."[89]

Finally, the Sunstein memorandum directs agencies to engage in "[c]onsideration of the interactive and cumulative effects of multiple regulations affecting individual sectors as part of agencies' retrospective analysis of existing rules, consistent with Executive Order 13,563."[90] This last point is of interest because it contains the most direct reference by the executive branch to "interactive effects" as distinct from cumulative effects. One interpretation of the distinction is that cumulative effects are negative interdependencies that accumulate over a large number of regulations, whereas "interactive effects" can be both negative or positive interdependencies and can exist between a small number of regulations.[91] Unfortunately, the memorandum stops there. "Interactive effects" is not defined or discussed further and is only mentioned in the context of retrospective review of regulations.[92]

What does this mean for agencies? At the very least, the two documents instruct agencies to consider negative interdependencies arising from costs between large numbers of rules. Executive Order 13,563's focus on "redundant" or "overlapping" rules further suggests that agencies should look at negative interdependencies between benefits as well, but it also suggests that positive interdependencies are not relevant to the consideration of cumulative effects.[93] The Sunstein memorandum is more explicit that benefits are relevant to the consideration of a regulation's cumulative effects, at least between new and existing regulations. The Sunstein memorandum also uses the term "interactive effects," which could be taken to suggest looking at interdependencies generally, even if they do not occur over a large number of rules, but this is also unclear.[94] In general, the exact purview of the "cumulative effects" language in

89. *Id*.
90. *Id*.; *see* Exec. Order No. 13,563.
91. *See*, *e.g.*, *infra* Part II.B.
92. *See* Sunstein Memorandum, *supra* note 86.
93. *See* Exec. Order No. 13,563.
94. *See* Sunstein Memorandum, *supra* note 86.

both documents leaves the contours of agency discretion uncertain, but, at the very least, suggests that the executive is becoming aware of the potential interactions between agency rules.[95]

PART II. THE PROBLEM OF INTERDEPENDENCY ERROR

Despite the current practice of understanding regulations' impacts individually against a baseline, regulations rarely, if ever, operate in a vacuum. Regulations interact directly and indirectly with one another and their costs and benefits will change relative to the number of other regulations with which they interact and the strength of that interaction. Without understanding the interdependencies between rules, agencies may produce a significant amount of regulation that imposes substantive and compliance costs on organizations while failing to achieve countervailing benefits for society. Since there is remarkably little discussion on this topic, we term this problem "interdependency error."

For example, imagine a situation where Regulation 1 limits Pollutant A and Regulation 2 limits Pollutant B. In both cases, the elimination of one pollutant also prevents the harms of the other pollutant. In effect, both Regulation 1 and 2 individually prevent the harmful results of both pollutants. When the regulations are evaluated independently, they both seem to be effective regulations, even if the costs of these regulations are independent. Meanwhile, if an agency addresses these regulations sequentially, then the first one will pass and the second will fail without any consideration of which regulation is more efficient.

This Part is focused on showing the presence of interdependencies inherent in the body of existing regulation and showing that without understanding these interdependencies, agencies cannot begin to properly fulfill their charge to ensure

95. Congress has also recently shown some concern for the cumulative effects of certain areas of regulation. *See*, *e.g.*, Courtney A Schultz, *History of the Cumulative Effects Analysis Requirement Under NEPA and Its Interpretation in U.S. Forest Service Case Law*, 27 J. OF ENVTL. L. & LITIG. 125 (2012).

that regulations benefit the public. First, we will discuss interdependencies in theory. Second, we will demonstrate the existence of interdependencies in practice. Third, we will discuss why current regulatory practices do not address interdependency error. We will consider possible explanations for why agencies have not developed a comprehensive approach to addressing interdependencies. Finally, legal support for addressing interdependency error is briefly discussed.

A. Interdependencies in Theory

Interdependencies exist between regulations in a variety of ways. This Article identifies four different types of interdependency that a collection of regulations may have: negative interdependencies, positive interdependencies, compound effects, and macro-interdependencies. These concepts have been applied only recently to literature on regulation[96] and without the level of rigor sufficient to analyze how CBA needs to account for them.[97] This section proceeds to review these concepts

96. After reviewing the literature, the first paper that seems to consider the possibility of interdependency in some detail, albeit narrowly in the realm of financial regulation, is Matthew Turk, *supra* note 5. Turk considers "regulatory substitutes" and "regulatory complements," which are similar, but not identical concepts to ours. *See infra* note 97 and accompanying text. Turk provides insight into how this topic has been treated in the past. "Of the three leading law-and-economics textbooks, direct reference to the concept of regulatory substitutes or complements appears only once and in passing. *See* RICHARD A. POSNER, ECONOMIC ANALYSIS OF THE LAW (9th ed. 2014) (no mention); STEVEN SHAVELL, FOUNDATIONS OF ECONOMICS ANALYSIS OF LAW (2004) (no mention); ROBERT COOTER & THOMAS ULEN, LAW & ECONOMICS, 184 (6th ed. 2012) (explaining the distinction between substitutes versus complements in a footnote)." *Id.* at 799 n.25.

97. While we agree with Turk that "a distinct framework for analyzing overlapping rules is conspicuously absent," *id*. at 799, we do not believe that Turk's characterization of substitute and complementary regulations is analytically useful, especially since it provides little guidance for the economic analysis of rules via CBA. Turk's definition of "regulatory substitutes" is imprecise and not amenable to quantification. Turk defines rules to be regulatory substitutes "if they are differentiated in a way that allows them to address distinct aspects of the same problem, with the result that each member of the pair works better than the other under at least some circumstances." *Id*. at 812. This is an unclear definition, and indeed we think it does not mean what he thinks it does—two regulations can both solve "aspects of the same problem" yet do not have interdependencies. For example, if two regulations reduce

from an economic approach and shows the numerous ways that a single regulation interacts with and influences the costs and benefits of the body of regulations in which it operates.

i. Negative Interdependencies

Simply put, 'negative interdependencies' occur when the impact of one regulation or a group of regulations is to reduce the net benefits of another regulation or group of regulations. For example, suppose an agency is considering a number of rules, R_1, R_2 . . . R_N. Rules R_1 to R_N exhibit negative interdependencies if the sum of the benefits and costs of passing all N rules is *lower* than the sums of the benefits and costs of passing each rule

carbon levels in different ways, and benefits are linearly increasing in carbon, then there is no negative interdependency, and the two effects do not really substitute for each other. Rather, our definition of a negative interdependency is more technically precise and suitable for agency use. Moreover, our definition of 'substitute effects', which explicitly states that there need to be diminishing returns to solving a particular regulatory problem or changing a relevant variable, is a more faithful definition of the intuitive notion of an imperfect substitute. *See supra* Part II.A.1. It is also important to note that Turk's regulatory substitutes and complements are not opposite to each other or exhaustive—there are important interdependencies that entail neither regulatory 'substitutes' nor 'complements' as defined by Turk: for example, if one rule merely blocks the effects of another rule, it is not an imperfect substitute in Turk's world, but the two rules nonetheless display negative interdependencies. Turk's definition also completely ignores negative cost interdependencies. Therefore, we believe our framework is more complete. Turk also only considers implications for financial regulation; we consider interdependencies for the administrative state more generally. Moreover, while Turk points out that CBA cannot account for regulatory substitutes and complements, it does not propose how agencies can nonetheless use CBA effectively. *See infra* Part IV.A. Because Turk does not use a CBA-based framework, he also fails to talk about the 'level' of regulation (also called 'regulatory intensity', Turk, *supra* note 5, at 838) precisely, and mentions of 'fewer' rules which do not have a technical meaning. *See, e.g.*, *id.* at 838 ("A necessary condition of this section's argument is that any move toward fewer [substitute] rules should be offset by a stricter application of the remaining regulations."). Finally, we disagree with Turk's characterization that complementary effects "generally require that a pair of rules play highly differentiated roles that nonetheless interlock in some subtle, mutually reinforcing way." *Id.* at 813. Rather, as we show, complementary effects—or in our terminology, positive interdependencies—are remarkably common, especially when there are increasing returns to regulating a particular effect. *See infra* Part II.A.2 and Part II.B.

alone.[98] In other words, there is at least one subset of the group of rules that has the effect of reducing the net benefits and costs of the remaining rules. This can occur either because the subset reduces the benefits of one or more remaining rules, or because the costs of complying with the subset of rules increases the cost of complying with one or more of the remaining rules.

If an agency ignores negative interdependencies—i.e., evaluating each rule without accounting for the reduction in net benefits caused by other rules—then it will pass more regulation than is optimal by overestimating the benefits or underestimating the costs. In this approach, a rule will seem more effective than it will be, since it is adjudicated against a baseline without rules that reduce its net benefits. Similarly, if the interdependency is ignored between existing rules and a new rule, then the realized net benefits of the new rule will be less than expected.

An important way negative interdependencies occur is through 'substitute effects,' which occurs when two or more rules achieve the same effect—such as reducing emissions of the same pollutant—and there are decreasing marginal benefits to that effect. Often, in the cases discussed, one rule is a partial substitute for another rule.[99]

ii. Positive Interdependencies

Rules can also have 'positive interdependencies,' which are the opposite of 'negative interdependencies.' Positive interdependencies occur when the impact of one regulation or a group of regulations is to increase the net benefits of another regulation or group of regulations. Suppose an agency is considering N rules, labeled R_1, R_2 . . . R_N. Rules R_1 to R_N exhibit positive interdependencies if the benefits and costs of passing all N rules is *higher* than the sums of the benefits and costs of

98. That is to say, $CBA(R_1, R_2 \ldots R_N) < CBA(R_1) + CBA(R_2) \ldots + CBA(R_N)$.

99. However, substitute effects are not the only way negative interdependencies occur—the latter can occur even if they do not achieve the same effect. For example, if a regulation merely blocks the effect of another rule, without achieving the same benefits, then it displays 'substitute' effects, despite not being a 'substitute' in the classical sense of the word.

passing each rule alone.[100] Passing a subset of the group of rules has a virtuous effect on other rules: it raises the net benefits of at least one of the remaining rules by increasing benefits or reducing costs. This can occur because the benefits of the rules compound, or because the costs of complying with a subset of rules reduce the cost of complying with one or more rules in the group of remaining rules.

If an agency ignores positive interdependencies—by evaluating each rule without accounting for the increase in net benefits caused by other rules—it will anticipate less benefits or greater costs than would materialize. As a result, it may mistake regulations with net benefits as regulations with net costs and therefore pass less regulation than is optimal.[101] Simply put, when passed together, rules that have positive interdependencies will have net benefits that are 'greater than the sum of their parts.'

iii. Compound Effects

Compound effects occur when additional rules change the nature of the negative and positive interdependencies impacting an existing set of rules. Negative and positive interdependencies might be particularly easy to analyze when considering only two rules. This analysis becomes more difficult to identify when considering three rules or more. For example, one can imagine a situation where there are three rules, A, B, and C. Each pair of rules displays negative interdependencies. But the three of them together create a strong positive interdependency. Consider the

100. That is to say, $CBA(R_1, R_2 \ldots R_N) > CBA(R_1) + CBA(R_2) \ldots + CBA(R_N)$.

101. It is worth noting that by the time agencies complete CBA, they are usually somewhat certain to pass the rule. *See* William F. West & Connor Raso, *Who Shapes the Rulemaking Agenda? Implications for Bureaucratic Responsiveness and Bureaucratic Control*, 23 J. PUB. ADMIN. RES. & THEORY 495, 498 (2013) (finding that most rules that reach the NPRM stage are ultimately promulgated); *see also* Jerry Ellig, *Why and How Independent Agencies Should Conduct Regulatory Impact Analysis,* 28 CORNELL J. L. & PUB. POL'Y 1 (2018). However, agencies will usually conduct preliminary economic analysis to have some idea of how the CBA process will go. Failing to account for interdependencies might skew the economic analysis at this early stage, deterring the agency from carrying out the required Notice of Public Rulemaking and subsequent CBA analysis.

following stylized example. A country is trying to prevent smuggling into its territory where there are three known smuggling routes: air, land and sea. Assume that each has unlimited capacity and that smuggling damages the economy by $200 million each year. Further assume that the cost of increasing security to eliminate smuggling on any route is $20 million per year and that if you increase security on more than one site, a headquarters must be built to coordinate the efforts costing $5 million. When regulation heightens burdens on smuggling through any one or two of these routes, smugglers will change tactics to use the remaining routes. As a result, if one or two routes are secured, then there will be costs incurred to the government of $20 million or $45 million per year, respectively, without any benefit, and thus yielding a net cost equal to that amount. However, if the government places restrictions on all three routes then there will be a net benefit of $135 million per year.[102]

iv. Macro-Interdependencies

In addition to the previous categories where interdependencies develop because of the substance of a regulation, there are also "macro-interdependencies." This term refers to interdependencies that develop among large numbers of rules that might be neglected when considering individual rules.[103] There are several reasons macro-interdependencies arise and impact the true net benefits of groups of rules.

First, costs often increase non-linearly as the number of regulations increases. Costs might not arise when considering small numbers of rules, but as the number of rules increases,

102. In an even more complex scenario, there could be a situation in which whether any two rules have negative or positive interdependency depends on a third rule. For example, if Rule C is part of a baseline for analysis of A and B, then A and B might exhibit negative interdependency. However, when Rule C is not part of a baseline for analysis, then no significant negative interdependencies are observed. This may be the case if Rule C has indirect effects (such as creating a change in behavior) that suddenly changes the benefits or costs of Rules A and B.

103. One technical way to describe a macro-interdependency is that it describes negative and positive interdependency, as defined above, for large levels of N.

companies must make significant changes to their structure that incur substantial additional costs. For example, with a small number of regulations, each might entail only small compliance costs for firms that will choose to leverage existing employees for the job. However, a large number of regulations might necessitate hiring outside lawyers, or establishing a compliance department, both of which entail significantly larger costs to businesses.[104] Second-order effects, such as deterring entry into markets, might also only be noticeable when the regulatory atmosphere is significantly more restrictive.[105] These have been addressed as cumulative effects by OIRA,[106] but there is little to

104. *Business Roundtable's Position on Regulatory Reform*, BUS. ROUNDTABLE, https://www.businessroundtable.org/archive/media/news-releases/business-roundtable-position-on-regulatory-reform (last visited Nov. 2, 2020) ("Taken individually, a regulation—or even several—may appear to be cost-effective and manageable. However, the cumulative impact of literally dozens of new major regulatory requirements facing all sectors of the economy over the next several years is something entirely different.").

105. This could be described as a chilling effect due to the number of regulations rather than the content of regulations themselves. The chilling effect of more regulation has been documented across the United States economy. *See, e.g.*, Myrisha S. Lewis, *Halted Innovation: The Expansion of Federal Jurisdiction over Medicine and the Human Body*, 5 UTAH L. REV. 1073, 1098 (2018) (discussing overregulation in medical research. "While non-legislative documents have been lauded for providing benefits such as flexibility in nascent industries, the FDA uses them to hinder the clinical use of innovations in the life sciences. The FDA accomplishes this by subjecting those innovations to burdensome regulatory requirements, which has a "chilling effect" on their clinical use.") (citing Myrisha S. Lewis, *How Subterranean Regulation Hinders Innovation in Assisted Reproductive Technology*, 39 CARDOZO L. REV. 1239 (2018) (discussing the FDA's issuance of Untitled Letters to providers of cytoplasmic transfer which ultimately led to the technique becoming unavailable in the United States)); Anthony Saliba, *Death by a Thousand Paper Cuts: The Slight, but Constant Chilling Effect of Overregulation*, LINKEDIN (Feb. 9, 2017), https://www.linkedin.com/pulse/death-thousand-paper-cuts-slight-constant-chilling-effect-saliba/ (discussing overregulation in businesses and the labor market. "A small business person or entrepreneur with a fresh start-up is going to look at the amount of regulation, become despondent and possibly choose not to take the risk of starting a company."); Barack Obama, *Toward a 21st-Century Regulatory System*, WALL ST. J. (Jan. 18, 2011, 12:01 AM), https://www.wsj.com/articles/SB10001424052748703396604576088272112103698 ("Sometimes, those rules have gotten out of balance, placing unreasonable burdens on business–burdens that have stifled innovation and have had a chilling effect on growth and jobs.").

106. *See* Sunstein Memorandum, *supra* note 86.

suggest that agencies have a rigorous framework for addressing macro-interdependencies.

Macro-interdependencies might also arise through under-enforcement. Large amounts of regulation impair an agency's ability to effectively enforce rules. Enforcing a rule itself incurs costs and requires continuous attention by an agency. An agency enforcing ten rules might be able to enforce infractions 100% of the time. However, an agency enforcing 100 rules might need to exercise discretion in choosing which cases to pursue. This may enable market participants to cheat, thereby reducing the net benefits of the regulation.

Regulatory overburden may also overload regulated entities and may lead them to accidently violate regulations, leading to macro-interdependency. This may especially be the case with small entities.[107] Regulated entities have limited attention and capacity to keep track of and comply with regulations.[108] As rules proliferate, entities will have a more difficult time ensuring compliance, once again failing to achieve the regulation's estimated net benefit.[109]

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107. *See* Small Business Regulatory Enforcement Fairness Act of 1996, Pub. L. No. 104-121, Title II, §§ 201 to 224, 110 Stat. 857-862 (1996), as amended Pub. L. No. 110-28, Title VIII, § 8302, 121 Stat. 204 (2007) *See* ("Congress finds that . . . small businesses bear a disproportionate share of regulatory costs and burdens"); *see also* Bailey & Thomas, *supra* note 9, at 247 (finding that regulations led to lower rates of birth of new firms).

108. *See* Ilya Somin, *Why the Rule of Law Suffers When We Have Too Many Laws*, WASH. POST (Oct. 2, 2017), https://www.washingtonpost.com/news/volokh-conspiracy/wp/2017/10/01/why-the-rule-of-law-suffers-when-we-have-too-many-laws/?utm_term=.303c04edff65 ("[I]t is almost impossible for small businesses to fully obey all the byzantine regulations that apply to them, for home and apartment owners to fully comply with every part of the complex building codes and zoning restrictions that apply in many jurisdictions, or for almost anyone to ensure perfect compliance with our hyper-complicated tax code.").

109. This situation is sometimes called 'regulatory overload.' *See, e.g.*, Andrew Hale et al., *Regulatory Overload: A Behavioral Analysis of Regulatory Compliance*, (George Mason Univ. Mercatus Ctr. Working Paper No. 11-47, Nov. 2011) https://www.mercatus.org/system/files/Reg_Overload_HaleBorysAdams_WP1147.pdf (finding that too many and too detailed regulations can reduce compliance, discourage innovation, and fuel uncertainty); *see also* Somin, *supra* note 108; Steven Davis, *Regulatory Complexity and Policy Uncertainty: Headwinds of our own Making* (presented at the Hoover Inst. Conference at Stanford Univ., Feb. 9–10, 2017),

Concern for macro-interdependencies, rather than being a legislative issue, is an issue to which agencies must pay close attention. First, Executive Order 13,563 explicitly mandates agencies to consider cumulative effects.[110] Moreover, statutory language does not specify that an agency should regulate one rule at a time, but tasks agencies with the broad responsibility of regulating a particular industry appropriately.[111] Therefore, an agency has the responsibility to find the best way, using the resources they have been granted, to achieve a particular outcome. If, for example, passing more regulations reduces the effectiveness of their overall regulatory approach, then agencies may be arguably failing to meet the task the statute has set for them. As a result, agencies should consider macro-interdependencies if significant interdependency error arises from it.

v. Interdependency Error: Agency Analysis and Timing

Interdependencies lead to error when agencies pass rules on the basis of CBA estimates. Whether or not agencies fail to pass, repeal, modify, or replace regulations properly due to interdependencies may depend on which regulations agencies have already passed. The effect that an interdependency has is largely a matter of timing; interdependencies have different effects depending on whether some of the rules are already enacted or are future potential rules not yet in consideration. There are a number of distinct cases in which CBA can lead to interdependency error. We analyze these below. Note that in all cases except Case 6, which analyzes the use of inaccurate

http://www.policyuncertainty.com/media/Davis_RegulatoryComplexity.pdf (arguing that the increased amount and complexity of federal regulation has had negative economic impacts and undermines regulatory goals).

110. *See supra* Part I.D.

111. For example, the Clean Air Act vests responsibility to take as much or as little action as the Environmental Protection Agency Administrator sees fit. 42 U.S.C. § 7521(a)(1) ("The [EPA] Administrator shall by regulation prescribe (and from time to time revise) in accordance with the provisions of this section, standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.").

baselines, we assume that agencies accurately include the effects of all previously promulgated rules in the baselines of all rules they are considering.

Case 1: The agency simultaneously considers promulgating multiple rules which have interdependencies

In the simplest case, there might be interdependencies between multiple rules that an agency is considering implementing. In this case, an agency is considering two rules and also carrying out CBA with each rule in respect only to existing rules and not each other. If there are substantial negative interdependencies, an agency may decide to promulgate each rule even when it should only promulgate one of them. If there are substantial positive interdependencies, an agency may promulgate neither rule when it should promulgate both rules.

Case 2: Interdependency between rules in place and rules being considered

In some cases, an agency might be worried about interdependencies between rules currently in place and those it is considering. Suppose that an agency is considering a rule, Rule B. This rule has interdependencies with another rule currently in place, Rule A. Given current agency practice, Rule A will be taken as already in place, and so will constitute part of the baseline for Rule B. If the optimal regulatory result entails Rule A remaining in place, an agency will correctly reach this conclusion. Since Rule A is part of the baseline in analyzing Rule B, negative and positive interdependencies are correctly accounted for.

However, the result of negative interdependencies might be that Rule A should be repealed, and Rule B should be instated in its stead. An easy example is if B is an alternative for Rule A that is more effective in achieving the regulatory objective. In such a case, current CBA practices will lead to an error, since Rule B might not be passed, or it might be passed without repealing Rule A.

By contrast, Case 2 will never yield errors when there are only positive interdependencies. In the example given, the

existence of Rule A makes Rule B more attractive. This turns up in the standard agency analysis, because an agency analyzes Rule B with Rule A in the baseline.

Case 3: Interdependency between eliminated rules and rules being considered

Similarly to Case 2, an agency might be concerned that an interdependency might arise between a rule that was previously eliminated from contention, and a current rule. Suppose that an agency is considering a rule, Rule B. This rule has interdependencies with another rule previously considered but not passed, Rule A.

If the two rules have sufficiently large positive interdependencies, then it might be true that it is optimal to pass both A and B, yet an agency will fail to do so since it will not go back and reconsider A with a baseline including B. Moreover, the fact that A was not promulgated might also lead the agency to find B undesirable, even though it should pass both rules.

Case 3 never yields errors when there are only negative interdependencies. If A was eliminated when considered on its own, the consideration of B will not change this analysis. Since A is correctly eliminated, the analysis of B will also proceed correctly.

Case 4: Interdependencies with future rules (not yet being considered)

An even more difficult case occurs when negative or positive interdependencies exist between currently considered rules and future rules not yet being considered. This may occur because agencies do not have a particularly good idea of the rules that they are expecting to pass in a rapidly changing regulatory environment.

Eventually, such a case will become an instance of Case 2 or Case 3, when the future rules come into the sphere of consideration. Which case applies depends on whether the current rule is passed or not. However, this fourth case is worth flagging separately because it adds another layer of practical difficulty for agencies. Anytime an agency considers a rule, there

might be a not-yet-considered rule which displays significant interdependencies.

How might an agency account for this? To a degree, Case 3 can be dealt with by waiting for the future rule to be considered, and then comparing its interdependencies to past rules. Once a potential rule actually enters the realm of consideration, agencies can compare it to existing rules or rules previously under consideration and determine if there are interdependencies that alter the analysis.[112]

Case 5: Interdependencies and sunsetting

Changes in the regulatory environment can cause rules to not achieve their calculated benefits or incur additional costs due to "sunsetting."[113] If an agency does not consider the disappearance of existing rule A with sunsetting provisions, it may fail to pass rule B, even if it should have, if there are negative interdependencies between the rules.

Case 6: Inaccurate Baselines

In the above analysis, we assume that agencies accurately include existing rules in their baseline for evaluating potential rules. However, interdependency error can also arise from inaccurate baselines, where an agency makes an assumption about the baseline that does not reflect the current regulatory landscape.

There are two categories of such error. The first possibility is that the agency, in its analysis of a rule, does not include the

112. Agencies would not only need to account for past rules, but for past rules that were considered, but not passed. New potential rules might create positive interdependencies that induce agencies to reconsider previous rules they had dismissed.

113. For example, many tariffs have sunsetting provisions. Specifically, all antidumping and countervailing duty orders must undergo review by Department of Commerce and the United States International Trade Commission (USITC) within 5 years of being issued. If the USITC makes a negative determination, the orders are automatically revoked. *See Understanding Five-Year (Sunset) Reviews*, U.S. INT'L TRADE COMM'N, https://www.usitc.gov/press_room/us_sunset.htm (last visited Nov. 24, 2020); 19 U.S.C. 1675(c).

effects of previously passed rules in the baseline. In such a case, the analysis proceeds as if the rules were being considered simultaneously, as in Case 1 above, and the possible errors are the same as for those. For example, in the subsequently discussed case on medical screening by OSHA, agencies simply ignored the degree to which other rules in place already mandated some of the medical tests that were part of the considered rule.[114]

The second possibility is that the agency, in conducting CBA, assumes the operation of other rules that are not, in fact, in place.[115] Such an assumption will create an error in both the case of positive and negative interdependencies. Suppose that there are regulations A and B, neither yet passed. The agency considers A, but assumes a baseline that already includes an operational B. If the two rules display negative interdependencies, and B is not part of the optimal pair of decisions, then an error arises if the inclusion of B in the baseline causes the agency to erroneously eliminate A from contention. If the two rules display positive interdependencies, and B is not part of the optimal pair of decisions, then the inclusion of B in the baseline causes the agency to erroneously promulgate A.

Case 7: Reliance interdependencies

In certain cases, the existence or size of interdependencies will depend on the reliance of private parties on the regulatory landscape. We term these 'reliance interdependencies.' Usually, these occur if there are significant fixed costs to compliance. For example, consider that an agency is considering rules A and B. Compliance technology 1 allows firms to meet the requirements of A, whereas more expensive compliance technology 2 allows firms to meet the requirements of A and B. Therefore, if A and B are implemented simultaneously, a firm can comply with both just by investing in technology 2, which is an example of a

114. *See infra* Part II.B.2.

115. Such an inclusion is harmless if these other rules are in fact part of the optimal group of rules. Errors only arise if these other rules would not optimally be promulgated. Then, their inclusion in the baseline will cause errors in the decision for the initial rule as well.

positive interdependency. However, if A is passed first, a firm (unless it expects B) will invest in the cheaper technology 1. If B is later passed, it will then also have to invest in technology 2, rendering its investment in technology 1 obsolete. This also negates the positive interdependency that would otherwise have existed. In this example, the passage of rule A might make it suboptimal to implement both A and B, even if A and B would otherwise be optimal. An agency will therefore act sub-optimally if it is not considering B when it is considering A, or if its CBA on the sequence of A and B assumes that they are implemented sequentially.

B. Interdependencies in Practice

The preceding section discussed interdependencies in theory. The goal of this section is to provide evidence that interdependencies occur often in practice. This section begins by looking at interdependencies in environmental regulations. In environmental policy, regulations often have similar goals, suggesting that interdependencies are likely to exist. Moreover, a positive change may have many ancillary benefits in a different area, which affect the effectiveness of other regulations which intend to achieve those benefits. We also look at safety regulations, where most safety regulations have negative interdependencies with each other because, similar to environmental regulations, multiple and sometimes duplicate regulations achieve the same benefits, and each additional regulation provides decreasing marginal returns. Finally, interdependencies are prevalent in financial regulations, where overlapping regulation often has negative interdependencies similar to the previous sections, but we also often see positive interdependencies. Finally, we discuss ancillary interdependencies that occur indirectly, often through market effects.

i. Environmental Regulations

Environmental regulations often have interdependencies because multiple regulations often show diminishing returns in achieving the same type of impact. Greenhouse gas (GHG)

emissions regulations are a classic example of this, leading to agency interdependency error, particularly since they tend to rely on calculation of a figure known as the social cost of carbon (SCC), referred to by climate economists as "the most important number you've never heard of."[116] Multiple EPA regulations target different entities with the goal of reducing greenhouse gas emissions.[117] Reducing levels of these emissions has significant positive impacts on human and environmental health.[118] To help quantify the benefits of reducing carbon emissions, agencies use a measure of the marginal social cost of the impacts of emitting an additional tonne of greenhouse gas, which is termed the social cost of carbon.[119] In doing so, agencies calculate a value (or range of values) for the social cost of carbon holding fixed certain aspects of the environment, including emissions levels. This means that agency figures for the social cost of carbon do not

116. *The EPA is rewriting the most important number in climate economics*, THE ECONOMIST (Nov. 16, 2017), https://www.economist.com/united-states/2017/11/16/the-epa-is-rewriting-the-most-important-number-in-climate-economics.

117. The EPA has produced a number of regulations under the CAA with similar benefits but different regulated entities. *See* Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, Final Rule, 75 Fed. Reg. 25323 (May 7, 2010); Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, Final Rule, 76 Fed. Reg. 57106 (Sept. 15, 2011); Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources; Electricity Generating Units; Proposed Rule, 77 Fed. Reg. 22392 (Apr. 13, 2012). For a deeper examination of the numerous regulations surrounding greenhouse gas emissions, *see* Philip A. Walsh, *U.S. Regulation of Greenhouse Gas Emissions*, GOVERNANCE STUDIES AT BROOKINGS (Oct. 2012), https://www.brookings.edu/wp-content/uploads/2016/06/26-climate-change-wallach.pdf.

118. *See e.g.*, Robert E. Hall et al., *Mercury Control Technology – A Review* (International Conference on Combustion, Incineration/Pyrolysis, Emission and Climate Change, 2006) (documenting that mercury emissions from power plants impair motor functions and cognitive skills and damage the cardiovascular, immune and reproductive system); Mark Z. Jacobson, *On the Causal Link Between Carbon Dioxide and Air Pollution Mortality*, 35 GEOPHYS. RES. LETTERS, L03809 (2008) (spelling out the direct link between increased levels of carbon dioxide in the atmosphere and increases in human mortality using a state-of-the-art computer model of the atmosphere).

119. *See* ENVTL. PROTECTION AGENCY, THE SOCIAL COST OF CARBON (2017), https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html (last visited Dec. 11, 2020).

explicitly account for how a change in emissions will alter the true marginal social cost of carbon.[120] However, because the total cost of carbon to society increases non-linearly with the levels of current carbon levels in the atmosphere, the true marginal social cost of carbon increases with the level of emissions. That is, the marginal cost of a tonne of greenhouse gases increases based on the amount of such emissions already in the atmosphere.[121] In fact, because of this, the social cost of carbon is expected to drastically increase in future years as greenhouse gases continue to accumulate in the atmosphere.[122] As a result, GHG regulations exhibit negative interdependencies, whereby each regulation decreases the net benefits of other GHG regulations because a reduction in emissions reduces the marginal benefit of an additional reduction in greenhouse gases. CBA estimates of such

120. *See, e.g.*, ENVTL. PROTECTION AGENCY, REGULATORY IMPACT ANALYSIS: FINAL RULEMAKING FOR 2017-2025 LIGHT-DUTY VEHICLE GREENHOUSE GAS EMISSION STANDARDS AND CORPORATE AVERAGE FUEL ECONOMY STANDARDS (2012) (using $5, $22, $37, and $68 as the various social costs of carbon). *See also* ENVTL. PROTECTION AGENCY, THE SOCIAL COST OF CARBON (2017), https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html (showing single value costs for carbon dioxide, methane, and nitrous oxide). Note that the social cost of carbon may *implicitly* account for emissions levels because the SCC figure is often recalculated, and the new calculations will account for changes in the regulatory atmosphere and total emissions. However, this is not sufficient to completely eliminate the effect of interdependencies on agency analysis.

121. Dozens of papers and studies have established that greenhouse gases such as carbon dioxide have non-linear impacts on temperature change. *See, e.g.*, Ram Ranjan, *Optimal Carbon Mitigation Strategy Under Non-linear Feedback Effects and in the Presence of Permafrost Trigger Hazard*, 19 MITIG. & ADAPTION STRATEGIES FOR GLOB. CHANGE 479 (2014) (finding that there is a carbon threshold which poses disproportionally larger risks to the environment); Lei Zhu et al., *A Non-Linear Model for Estimating the Cost of Achieving Emission Reduction Targets: The Case of the U.S., China, and India,* 21 J. SYS. SCI. SYS. ENG. 297 (2012). There is discussion on how this non-linearity confounds the usefulness of social cost of carbon estimates. *See*, *e.g.*, *Q&A: The social cost of carbon*, CARBONBRIEF, https://www.carbonbrief.org/qa-social-cost-carbon (last visited Dec. 11, 2020).

122. ENVTL. PROTECTION AGENCY, THE SOCIAL COST OF CARBON, *supra* note 120 ("As discussed in the 2010 SC-CO2 TSD, estimates of the social cost of these greenhouse gases increase over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change, and because GDP is growing over time and many damage categories are modeled as proportional to gross GDP.").

regulations based on a SCC number will ignore such interdependencies, and can potentially lead to erroneous decisions about which GHG regulations to pass.[123] Similar interdependency effects occur in almost all contexts where regulations target a common pollutant which imposes costs on society non-linearly.

Interdependencies can also occur in environmental regulation through the development of control technologies. 'Control technologies' are technologies required by regulations to accomplish their objectives. When an ancillary benefit of the control technology is similar to the other regulation's intended effect, and that benefit has decreasing marginal effect, a negative interdependency arises. For example, in 2012 the EPA completed its regulatory impact analysis of the National Ambient Air Quality Standards for Particulate Matter (NAAQSPM). During its analysis it found that the control technology required to remove particulate matter of less than 2.5 micrometers also had the effect of removing particles of less than 10 micrometers but greater than 2.5 micrometers.[124] As a result, the regulation removed mercury and other harmful chemicals from the air

123. Whether reliance on SCC numbers will lead to over- or under-regulation will depend on the particular assumptions that go into the SCC, the timing of regulations, and the frequency with which the SCC number is updated to account for changes in emissions levels. Generally, considering multiple GHG rules using a common SCC risks over-regulation, since a negative interdependency is ignored. However, use of a SCC figure can also create serious errors if the calculation of such a figure makes assumptions about the regulatory environment (and therefore total emissions) that are inaccurate. *See* discussion *supra* Part II.A.5, Case 6 and accompanying text. If such calculations are overly optimistic about the future levels of regulation (and thus understate the true level of future emissions), then CBA estimates that use the social cost of carbon figure will be too low and agencies may under-regulate as a result. By contrast, if the social cost of carbon ignores regulations already in place, it might lead to overly optimistic estimates of the benefits of considered regulation, and regulations may be passed that should not be.

124. *See, e.g.*, ENVTL. PROTECTION AGENCY, REGULATORY IMPACT ANALYSIS FOR THE FINAL REVISIONS TO THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER 4.A-1 (2012), https://www3.epa.gov/ttn/ecas/regdata/RIAs/finalria.pdf (discussing control technologies focused on the reduction of fine particle emissions, particles less than or equal to 2.5 micrometers, also called PM2.5, from non-EGU point and nonpoint sources and acknowledging that such technologies will simultaneously reduce emissions of PM10).

beyond the intended scope of the regulation. While this is a good thing, this likely reduces the future net benefits of mercury emission regulation.[125]

A similar finding previously occurred involving the control technologies for the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR).[126] CAMR was designed to limit emissions of and human exposure to methylmercury, which generally occurs through the consumption of fish. The total cost of changing control technologies under to CAMR was expected to be between $3.9 and $6.0 billion between 2007 and 2025.[127] Due to future changes to control technologies already imagined under CAIR, this cost was actually reduced to between $2.2 and $3.9 billion.[128] However, CAIR also reduced the total incremental IQ benefits (benefits associated with mitigating IQ loss by reducing exposure to mercury) received by CAMR to only between $0.25 and $1.56 million.[129] The negative interdependency seen here led the EPA to feature this case study in its *Guidelines for Preparing Economic Analysis*.[130]

Negative interdependencies also arise in certain situations where environmental regulations are implemented in series. For example, in order to reduce phosphorous emissions into waterways, seventeen states banned the sale of high-phosphorus dishwasher detergent.[131] High levels of phosphorus in

125. It may also increase the net benefits if, for example, the additional reduction of NAAQSPM significantly lowers the cost of complying with other mercury emissions regulations.

126. *See* 70 Fed. Reg. 25161 (May 12, 2005); 70 Fed. Reg. 28605 (May 18, 2005). The Clean Air Interstate Rule was replaced by the Cross-State Air Pollution Rule (CSAPR). *See* 76 Fed. Reg. 48207 (Aug. 8, 2011).

127. ENVTL. PROTECTION AGENCY, REGULATORY IMPACT ANALYSIS OF THE FINAL CLEAN AIR MERCURY RULE, at 7-7 (2005).

128. *Id.* at 7-20.

129. *Id.* at 11-15.

130. *See* ENVTL. PROTECTION AGENCY, GUIDELINES FOR PREPARING ECONOMIC ANALYSES (2010, updated 2014), https://www.epa.gov/sites/production/files/2017-08/documents/ee-0568-50.pdf [hereinafter EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES].

131. *See* Alex Cohen & David Keiser, *The Effectiveness of Overlapping Pollution Regulation: Evidence from the Ban on Phosphate in Dishwater Detergent* 4–3, 8 (Selected Paper prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, July 31 to Aug.

wastewater leads to eutrophication, evidenced by noxious algal blooms that damage wildlife and impose significant monetary and non-monetary costs to society. However, household water must pass through and be processed by waste-water plants before moving into waterways. Many of these plants already had limits on the amount of phosphorous that they could discharge. Since these plants attempt to limit their costs, they had no incentive to reduce phosphorous levels below their limit, and therefore the majority of the reduction in household phosphorous emissions turned into cost savings for waste-water plants. As a result, the household ban had a fifth of the benefits that states expected.[132] This shows how environmental rules implemented in a series may have negative interdependencies as the envisioned impacts of one rule supersede or are superseded by another.

In a slightly different context, one study has revealed an area where additional environmental regulations would significantly increase net benefits. Groosman et al. found that the Warner-Lieberman bill (S.2191) of 2008, which would have established a national cap-and-trade scheme for greenhouse gases, would have had substantial benefits that outweigh its costs.[133] However, these benefits are reduced by the fact that SO2 levels might 'backslide' up to the CAIR cap on emissions, diminishing many of the ancillary benefits of the Warner-Lieberman policies.[134] This

2, 2016) (exploring how bans on high-phosphorus dish soaps failed to reduce phosphorus effluent because overlapping regulation allowed waste-water treatment facilities, cost minimizers, to simply remove less phosphorus from the water than before rather than similarly reduce output. Cohen and Keiser found that "for every 1 percent of phosphorus influent reduced in impaired waterways, phosphorus effluent has been reduced by just 0.18 to 0.21 percent.").

132. *Id.* at 36 (finding that expected effluent reductions from a Phosphate ban were only of 18 to 21 percent of the expected level, due to regulation of waste-water plants).

133. Britt Groosman et al., *The Ancillary Benefits from Climate Policy in the United States*, 50 ENVTL. & RESOURCE ECON. 585 (2011) [hereinafter Groosman et al., *Ancillary Benefits*, ENVTL & RESOURCE ECON.]. The bill did not pass. *See* Lieberman-Warner Climate Security Act of 2007, S.2191, 110th Cong. (2008).

134. Groosman et al., *Ancillary Benefits*, ENVTL & RESOURCE ECON., *supra* note 133, at 588 (The large share of total co-benefits that are due to SO2 abatement from coal-fired power plants is evidenced in modeling Scenario 3 where SO2 emissions from such facilities are allowed to increase to the CAIR cap; relative to the policy scenario with the default assumptions, co-benefits decrease by 65%). *See also* Britt Groosman et al., *The Ancillary Benefits from*

unfortunate mitigating effect occurs because, while cap-and-trade will reduce the number of coal fire power plants, existing plants will take advantage of the lower aggregate levels of emissions to increase their SO2 emissions to the levels permitted by CAIR, negating the impact of fewer coal plants.[135] As a result, much of the estimated benefits of the regulation—the estimated amount being $77 billion—will not materialize.[136] By contrast, as the authors state, if additional regulation adjusts the CAIR emissions standards, the full benefits of the regulations are realized. In effect, such additional regulation and the Warner-Lieberman cap-and-trade policies exhibit positive interdependencies and demonstrate the importance of watching for the responses of private actors to new incentives created by regulation.

Another interdependency arises from the possibility of "cross-media substitution"—regulations limiting a firm's ability to pollute in one medium (for example, air, ground, or water) might cause them to substitute into the other media.[137] The existence of

Climate Policy in the United States, (Middlebury Coll. Econ. Discussion Paper No. 0920, 2009), https://sandcat.middlebury.edu/econ/repec/mdl/ancoec/0920.pdf [hereinafter Groosman et al., *Ancillary Benefits*, Discussion Paper] ("Among the most important assumptions is whether remaining coal-fired generation capacity is permitted to "backslide" up to the Clean Air Interstate Rule (CAIR) cap on emissions. This analysis models two scenarios specifically related to this issue. Co-benefits increase from $90 billion, when the CAIR cap is met, to $256 billion if SO2 emissions are not permitted to exceed current emission rates.").

135. Groosman et al., *Ancillary Benefits*, Discussion Paper, *supra* note 134, at 5 ("Relative to the policy scenario with default assumptions, when SO2 emissions form the electric power generators regulated under CAIR are permitted to backslide up to the extant CAIR cap, co-benefits decrease by $167 billion in present value terms to approximately $90 billion. This result suggests that a climate policy that does not address the issue of SO2 emissions management under CAIR is likely to forego substantial health-related co-benefits.").

136. *Id*.

137. For example, one author explains that "It is widely believed, however, that much of the reduction is due to air-pollution-abatement devices such as scrubbers and electrostatic precipitators. These abatement devices remove the pollutants from the air, but they are generally not eliminated, and the residuals are released into water bodies, landfills, or injected into the ground." Michael Greenstone, *Estimating Regulation-Induced Substitution: The Effect of the Clean Air Act on Water and Ground Pollution*, 93 AM. ECON. REV. 442, 442 (2003). *See also* Hilary Sigman, *Cross-Media Pollution: Responses to*

cross-media substitution creates positive interdependencies, since regulating both media prevents cross-media substitution from negating the benefits of one medium.[138] On the other hand, in some cases, pollutant regulation of one medium—notably, clean air regulation—reduces pollution in other media as well, perhaps by incentivizing the move to more efficient production technologies.[139] In those cases, there would likely be negative interdependency, driven by the fact that the regulations are partial substitutes. In both cases, interdependencies exist, and an agency that does piecemeal CBA risks committing interdependency error.

ii. Safety Regulations

Significant interdependencies also exist in the realms of public health and safety. Important examples exist in the realm of road safety regulation, where various measures to improve vehicle safety interact with each other in a number of different ways. For example, in late 2016 the National Highway Traffic Safety Administration (NHTSA) proposed (without following up) a rule mandating that light vehicles have vehicle-to-vehicle communication systems that will reduce the number of intersection and left-turning crashes.[140] As part of this, the NHTSA carried out a preliminary economic analysis. The proposed rule exhibits interdependencies with other NHTSA rules, such as rules requiring airbags,[141] rules requiring rear

Restrictions on Chlorinated Solvent Releases, 72 LAND ECON. 298 (1996); Edward S. Rubin & Francis Clay McMichael, *Cross-Media Environmental Impacts of Air Pollution Regulations for a Coal-Fired Power Plant*, 28 J. AIR POLLUTION CONTROL ASS'N 1099 (1978).

138. However, it might also create negative interdependency, because being able to substitute into other media is significantly cheaper than having to eliminate emissions altogether.

139. *See* Greenstone, *supra* note 137; Sigman, *supra* note 137.

140. *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., PRELIMINARY REGULATORY IMPACT ANALYSIS: FMVSS NO. 150 VEHICLE-TO-VEHICLE COMMUNICATION TECHNOLOGY FOR LIGHT VEHICLES (2016), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/v2v_pria_12-12-16_clean-2.pdf.

141. *See* Federal Motor Vehicle Safety Standards; Occupant Crash Protection; Occupant Crash Protection, 65 Fed. Reg. 30679 (May 12, 2000) (codified at 49 C.F.R. pts. 552, 571, 585 and 595).

visibility systems,[142] and seatbelt rules.[143] Indeed, all of these rules are likely to exhibit significant interdependencies and, given that some of these rules are knife-edge cases in terms of whether they produce negative or positive estimates,[144] it is likely that accounting for interdependencies would change the eventual decisions that the agency makes on these rules.

Rules that are considered alternatives during the rulemaking process and those safety regulations that are classified as redundant in practice are classic examples of negative interdependencies through benefits. Another stark example of rulemaking regarding road safety exists. In *Motor Vehicle Manufacturers Association v. State Farm Mutual*,[145] the court declared that the NHTSA needed to consider nondetachable belts and airbags as a possible alternative to rescission of the rule on detachable belts[146] The Court required this consideration because the rules (nondetachable vs. detachable) might feasibly capture each other's benefits while imposing similar costs.[147] Subsequently, the Court held that considering these alternatives were important because one could replace the other. By this same reasoning, these two rules exhibit negative interdependencies since implementing both rules (and essentially requiring two seatbelts) would only slightly improve safety while doubling costs.

Another example of this is safety regulation in construction sites. As certain dangerous breathable substances are banned from worksites, the benefits of worker protective gear including the use of protective masks or respirators decreases because

142. *See* Federal Motor Vehicle Safety Standard, No. 111 Rear Visibility, 84 Fed. Reg. 54533 (Oct. 10, 2019) (codified at 49 C.F.R. pt. 571).

143. *See* Federal Motor Vehicle Safety Standards; Occupant Crash Protection; Occupant Crash Protection, 69 Fed. Reg. 70904 (Dec. 8, 2004) (codified at 49 C.F.R. pts. 571, 585, 586, 589, 590, 596, 597).

144. *See* Arden Rowell, *Partial Valuation in Cost-Benefit Analysis*, 64 ADMIN. L. REV. 723, 727 (2012) (noting that the consideration of unquantified benefits led the NHTSA to pass a rule that was otherwise not effective).

145. 463 U.S. 29 (1983).

146. *Id*. at 51, 55.

147. *Id.* at 31 ("NHTSA did not suggest that the emergency release mechanisms used in nondetachable belts are any less effective for emergency egress than the buckle release system used in detachable belts.").

there are fewer harmful chemicals to be protected from.[148]

Interdependencies exist between the health screening and surveillance standards of Permissible Exposure Limits (PELs) imposed by the Occupational Safety and Health Administration (OSHA) for different potentially harmful chemicals. Each of these standards imposes requirements that employees be regularly screened for their health. Despite the fact that there is significant overlap in the screening requirements and medical tests mandated by OSHA,[149] the economic analysis of the most recent one, the Crystalline Silica rule,[150] ignored the degree to which existing health screening and surveillance reduced the costs of additional requirements for screening and surveilling employees for the effects of Crystalline Silica. This counts as a significant positive interdependency.

In a similar sense, rules increasing the levels of training requirements for employees—as a number of OSHA rules mandate[151]—of a particular industry might improve compliance levels for other regulations, including particular matter standards, thus improving the net benefits of those rules and functioning as another significant type of positive interdependency.

A final form of interdependency that has been discussed in the literature is that arising from the cumulative impacts of

148. Of course, this will only truly be a negative interdependency if the increased benefits of worker health are greater than the lost benefits from respirators and the cost of changing substances. *See* Assigned Protection Factors, 71 Fed. Reg. 50121 (Aug. 24, 2006) (codified at 29 C.F.R §§ 1910, 1915, 1926) (discussing the benefits of respirators as a product of the harmful chemicals that workers avoid breathing in).

149. Consider the fact that many of the screening and surveillance tests for different chemical substances are the same. *See* OCCUPATIONAL SAFETY & HEALTH ADMIN., MEDICAL SCREENING AND SURVEILLANCE REQUIREMENTS IN OSHA STANDARDS: A GUIDE (2014), https://www.osha.gov/Publications/osha3162.pdf. However, costing procedures for CBA measures costs for each chemical from scratch. *See*, *e.g.*, OCCUPATIONAL SAFETY & HEALTH ADMIN., PRELIMINARY ECONOMIC ANALYSIS AND INITIAL REGULATORY FLEXIBILITY ANALYSIS (2013) at V-1, https://www.osha.gov/silica/Silica_PEA.pdf.

150. *See* 81 Fed. Reg. 16285 (Mar. 25, 2016) (codified at 29 C.F.R. pts. 1910, 1915 and 1926).

151. *See* OCCUPATIONAL SAFETY & HEALTH ADMIN., TRAINING REQUIREMENTS IN OSHA STANDARDS, https://www.osha.gov/Publications/osha2254.pdf.

different chemicals, pollutants and pesticides.[152] In an article about the agency failure to consider the cumulative impact of toxic substances and chemicals, Sanne Knudsen writes that "[d]espite evolutions in scientific thinking, the implementation of the two major federal environmental laws most directly impacting the entry of chemicals and pesticide to the marketplace—the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)—have largely ignored issues of cumulative risk."[153] She writes further that chemicals and pesticides are generally regulated on a "chemical-by-chemical basis instead of based on real-world exposures."[154] This is a clear case where rules regulating chemicals display positive interdependency with each other—together, they avoid the greater harms that result from cumulative exposure.[155] Yet, the chemical-by-chemical analysis that agencies conduct fails to account for these cumulative benefits.

iii. Financial Regulations

Interdependencies are common in financial regulation as well.[156] The most clear-cut examples of this are the duplicative disclosure requirements of the Securities Act of 1933 and the Securities Exchange Act of 1934. In a seminal 1966 paper, Milton Cohen argued that the disclosure system would have been extremely different had these acts been passed in reverse

152. *See* discussion *supra* note 95.

153. Sanne H. Knudsen, *Regulating Cumulative Risk*, 101 MINN. L. REV. 2313, 2315 (2017).

154. *Id.* at 2315.

155. Knudsen writes that in some situations "individual risks [of toxic substances] operate synergistically such that the sum is worse than the parts." *Id.* at 2332.

156. The use of CBA in financial regulation is itself controversial. *See* John C. Coates IV, *Cost-Benefit Analysis of Financial Regulation: Case Studies and Implications*, 124 YALE L.J. 882 (2015). But CBA is useful for at least some types of financial regulation. *See* Cass R. Sunstein, *Financial Regulation and Cost-Benefit Analysis*, 124 YALE L.J. F. 263, 270–75 (2015), http://www.yalelawjournal.org/forum/financial-regulation-and-cost-benefit-analysis [http://perma.cc/QU95-F8QV]. MCBA will also be effective in these cases.

order.[157] The 1933 Act matches disclosure to the timing of when an issuer sells securities while the 1934 Act created a system of continuous, periodic, company-specific disclosure on top of the transaction—specific requirements of the 1933 Act, drastically reducing the benefits of transaction—related disclosure. Scholars have suggested that if these acts had been passed in reverse order, no one would have imposed the 1933 Act's disclosure requirements due to their negligible benefits.[158]

Negative interdependencies also exist between bank leverage ratios and the plethora of bank safety measures including Dodd-Frank capital buffers, stress tests, liquidity requirements, and weighted asset ratios.[159] Negative interdependencies are present here because a bank with a higher leverage ratio is exposed to lower default risk, and other safeguards also seek to protect from this risk. For example, if the bank leverage ratio was raised to 100%, a bank cannot default to creditors and the benefits of other bank safeguards are reduced to zero.[160] Finally, living wills and total loss absorbing capital (TLAC) levels exhibit negative interdependencies because increased levels of total loss absorbing capital reduce the need for living wills by making a ready source of capital available. Negative interdependencies are therefore seen between living wills and capital adequacy requirements.[161]

Additionally, financial regulations demonstrate positive interdependencies when implementing rules together creates more market-efficient outcomes. A positive interdependency exists when creating corresponding levels of bank supervision and deposit insurance. For example, assume that new

157. Milton H. Cohen, *"Truth in Securities" Revisited*, 79 HARV. L. REV. 1340 (1966).

158. Similar to the seatbelt example, this doubles costs while providing few increased benefits. *See* John C. Coffee, Jr., *Re-Engineering Corporate Disclosure: The Coming Debate over Company Registration*, 52 WASH. & LEE L. REV. 1143, 1145 (1995) (discussing how the overlapping original securities disclosure laws were consolidated into Regulation S-K).

159. *See generally* Pub. L. No. 111-203, 124 Stat. 1376 (2010) (codified as amended in scattered sections of the U.S. Code).

160. Example modified from Turk, *supra* note 5, at 835.

161. Assuming that the benefits of increased TLAC levels is less than the sum of the TLAC cost and the reduced benefits to living wills and other financial safety measures. Example modified from *id.* at 853.

information comes to light saying that banks are more likely to engage in risky behavior than previously expected. In this situation, increasing bank supervision will help curb this behavior. If current levels of bank supervision are market efficient, it would create net costs to raise supervision levels when considering standard compliance alone. However, when increasing supervision curbs risky behavior, it also decreases potential losses to the FDIC, therefore creating total net benefits. In this way, there is a positive interdependency between deposit insurance and bank supervision.[162]

iv. Ancillary Interdependencies

"Ancillary interdependencies" occur when regulations have second-order, often unintentional effects on the efficacy of other regulations which result from the changes in incentives and conduct of private actors. Most often, this happens in the sense of market effects: demand, supply, and prices being affected by regulations with potentially far-reaching effects.

Regulations might spur innovation into new technologies and means of compliance, which would lead to significant positive interdependency, since such innovation might only "take off" once the regulatory burden reaches a substantive level. There is substantial evidence that this innovation in regulatory compliance takes place across a number of different industries.[163]

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162. This is taken from, but significantly different than, the example in Turk, *supra* note 5, at 812. Turk identifies a positive interdependency in this situation regardless of market efficient outcomes because he only looks at the benefits without considering costs. As a result, his methodology can lead to more inefficiencies without helping agencies set the right policies. For a discussion, see *id.* at 800–06, 808 n.53.

163. *See* FINRA, TECHNOLOGY BASED INNOVATIONS FOR REGULATORY COMPLIANCE IN THE SECURITIES INDUSTRY (2018), https://www.finra.org/sites/default/files/2018_RegTech_Report.pdf; David Popp, *International Innovation and Diffusion of Air Pollution Control Technologies: The Effects of NOX and SO2 Regulation in the US, Japan, and Germany*, 51 J. ENVTL. ECON. & MGMT. 46–71 (2006) ("the data suggest that inventors respond to environmental regulatory pressure in their own country"); *see Regtech is the New Fintech: How Regulatory Technology is Helping Better Understand and Manage Their Risks*, DELOITTE 4 (2015), https://www2.deloitte.com/content/dam/Deloitte/ie/Documents/FinancialServices/IE_2016_FS_RegTech_is_the_new_FinTech.pdf.

Similarly, regulations can cause changes to the competitive structure of the market, imposing unforeseen changes in costs and benefits of other regulations. For example, excessive regulation might lead to firm exits despite the fact that no single substantive regulation requires firms to leave the market.[164] This can alter consumer prices and product availability in a way that is not measured by the CBA on any one particular rule.

Ancillary interdependencies also often occur when private actors change their behavior in unintended ways. For example, a well-noted undesirable feature of energy-efficiency regulation is that by lowering energy costs, it will often incentivize individuals to consume more energy, negating its supposed advantages of reducing energy consumption.[165] This creates positive interdependency with rules designed to curb energy usage, such as those incentivizing lower energy use by consumers or those that directly regulate fossil fuels.[166] In general, rules that create benefits but distort individual incentives to induce undesirable behaviors will have positive interdependencies with rules that directly attempt to curb such behaviors.[167]

164. *See* Regulatory Flexibility Act, 5 U.S.C. §§ 601–612 (Supp. IV 1980) (creating new legislation in part to prevent excessive regulatory requirements from forcing firms to leave the market); *see also* Bailey & Thomas, *supra* note 9, at 247 (finding that regulation led to lower levels of small firm entry into a market).

165. For example, developing a fuel-efficient car might incentivize individuals drive more. This effect is called the "rebound effect," and a survey of the literature studying it is available in Kenneth Gillingham et al., *The Rebound Effect and Energy Efficiency Policy*, 10 REV. OF ENVTL. ECON. & POL'Y (2015).

166. For examples of incentive-based regulations, *see* EPA summary of program offerings that incentivize consumer energy savings, EPA, *Customer Incentives for Energy Efficiency Through Program Offerings* (2010), https://19january2017snapshot.epa.gov/sites/production/files/2015-08/documents/customer_incentives_for_energy_efficiency_through_program_offerings.pdf. For an example of direct federal regulation of fossil fuels, *see e.g.,* FERC, *What FERC Does*, https://www.ferc.gov/about/what-ferc/what-ferc-does (last visited Dec. 10, 2020).

167. In yet another compelling example of this, an economic study finds that regulations on the amount of permissible fishing can have large adverse health impacts by changing the incentives of fishers and the amount of resulting pollution, creating potential positive interdependencies with air regulation. *See* Christopher Hansman, Jonas Hjort & Gianmarco Leon, *Firms' Response and Unintended Health Consequences of Industrial Regulations*, BARCELONA GSE

v. Interagency Interdependencies

Often, there are significant interdependencies between the rulemakings of different agencies. In fact, all the above interdependencies types can also apply to rules issued by different agencies. The potential for agencies to have rules that interact in their effects has received more coverage in the literature as a problem of "overlapping agency jurisdiction,"[168] perhaps due to the fact that overlaps between agencies tend to be more egregious and more obviously inefficient.[169] Our own analysis will generally not focus on cases of agency overlap. However, the subsequent principles and tools of MCBA, we suggest, should be coordinated between agencies where possible.[170] For example, as discussed, Agency Commonality Lists could be used to address cases of agency overlap.[171]

C. Current Attempts to Address Interdependencies

Agencies have used various approaches that partially address the interdependency problem. Unfortunately, none of them effectively allow agencies to solve the problem of interdependency error. In this section, we examine the various ad-hoc approaches agencies have considered or used: combining

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WORKING PAPER, Feb. 2015, at 4, https://www.barcelonagse.eu/research/working-papers/firms-response-and-unintended-health-consequences-industrial-regulations ("We conclude (a) that the introduction of individual property rights aimed at preserving fish stocks and sector profits in Peru exacerbated the fishmeal industry's impact on health because changes in incentives and industry dynamics led production to be spread out in time in most locations; and (b) that the two are linked because longer periods of exposure to moderate levels of air pollution are worse for health than higher intensity, shorter periods of exposure. Overall our findings highlight the risk of piecemeal regulatory design.").

168. *See e.g.,* Mary Margaret Milner & Carol P. Kelley, *Res Judicata and Administrative Jurisdiction—A Prosposal for Resolving Conflicts Between Agencies with Overlapping Jurisdiction*, 35 GEO. WASH. L. REV. 1056 (1967); *see also* Jacob Gersen, *Overlapping and Underlapping Jurisdiction in Administrative Law*, 2006 SUP. CT. REV. 201 (2006).

169. *Reducing Regulatory Overlap in the 21st Century*, BUS. ROUNDTABLE 1 (2019) ("Such regulatory overlap poses significant challenges to American businesses and can dampen economic activity across the wider U.S. economy.").

170. *See infra* Part III.B and Part III.C.

171. *See infra* Part III.C.

rules, actual/statutory timing, multiple baseline approaches, cumulative effects, and retrospective review.

i. Combining Rules

The EPA has considered the issue of rule interaction and discussed it in their guidelines. In one approach, these guidelines instruct the agency to carry out CBA on a number of rules at the same time in order to address the interdependency problem.[172] The main problem with combining linked rules is that the current approach does not lay out methods for choosing sets of rules to test. This needs to be done deliberately. Without a formalized approach, agencies may spend unnecessary amounts of resources on doing this analysis or analyze rules together for political ends. Moreover, the EPA approach does not define when rules that fail this type of CBA should be discarded. This approach may lead agencies to discard rules that combined analyses have negative CBA results but in conjunction with a different combination of rules or alone have large net benefits. Finally, this approach fails to overcome the statutory timing issue, whereby one or more rules with low net benefits already in the baseline interferes with the effectiveness of new rules being considered. In this way, agencies may continue to commit interdependency error even when using this procedure to pass new rule sets.

172. *See* EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130, at 5-11 ("In some cases it is possible to consider multiple rules together as a set. For example, some regulatory actions have linked together rules that affect the same industrial category. This was true of the pulp and paper effluent guidelines and National Emissions Standards for Hazardous Air Pollutants (NESHAP) rules (U.S. EPA 1997c). In other cases, multiple rules may not necessarily be a set of similar policies associated with the same industry, but rather are a set of different policies that are all necessary to achieve a policy objective . . . The optimal solution in both of the cases described above is to include all of the rules in the same economic analysis. In this case, the multiple rules are analyzed as if they were one rule and the baseline specification simplifies to one with none of the rules included. While statutory requirements and judicial deadlines can inhibit promulgating multiple rules as one, coordination between rulemaking groups is still possible.").

ii. Multiple Baselines

As discussed in Circular A-4[173] and the EPA guide,[174] agencies are expected to incorporate multiple baselines in their analyses when the rule's impacts with various baselines is uncertain.[175] In theory, a rich enough multiple baseline approach is sufficient to solve the problem of interdependencies. Consider that an agency is considering two rules, A and B. Let B_{00} denote the net benefits from no regulation (baseline). Normalize this to 0. Let B_{10} denote the net benefit from regulation a, let B_{01} denote the net benefits from regulation B. Let B_{11} denote the net benefits from introducing both regulations.

	No B	**B**
No A	0	B_{01}
A	B_{10}	B_{11}

Now suppose that an agency conducts multiple baseline CBA. It conducts CBA for every baseline possible by altering whether another rule gets passed. So, for regulation B, it would carry out a round of CBA assuming A was introduced, and another assuming A was not introduced. This gives us $B_{11} - B_{10}$ and B_{01}. Applying the same logic to A, multiple baseline CBA gives us B_{10} and $B_{11} - B_{01}$.

The joint benefit, B_{11}, can thus be inferred from the

173. *See* OMB, CIRCULAR A-4, *supra* note 70.

174. *See* EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130, at 5-12.

175. *Id.* at 5-11 ("Even the potential implementation of another such rule may affect the benefits and costs of an EPA regulation being analyzed, due to the strategic behavior of regulated entities. Therefore, it is important to consider the impact of other rules when establishing a baseline. If another federal, state, or local agency is legally required to impose a regulation but is still in the process of finalizing that regulation, then a baseline which includes this impending regulation should be considered. The intent of the baseline is always to characterize the world in the absence of regulation being analyzed.").

individual analysis, either by adding the estimated B_{01} to $B_{11} - B_{01}$, or by adding B_{10} to $B_{11} - B_{10}$. This is also true of any arbitrary number of considered rules if every possible baseline is considered.

However, in a practical sense, multiple baseline analysis is not the most effective solution for agencies to use. The first problem is that if an agency considers a large number of rules, the number of possible baselines for a given rule is unreasonably large.[176] Thus, it will not be clear how to do this using a baseline approach. Second, for rules that have not yet been implemented, it is difficult for an agency to calculate the baseline. Essentially, it is the equivalent of conducting CBA for that rule itself. That is to say, in the above example, if an agency wants to implement a rule $B_{11} - B_{01}$, it might need to calculate B_{01} in order to determine the baseline with rule B in place. It might therefore be easier to think of matters in terms of CBA on combinations of rules, as opposed to individual rules with multiple baselines. Finally, it is also important to point out that using the multiple baseline approach does not examine potential interdependencies between rules assumed true in the study, since they are not the focus of the study.[177]

iii. Actual or Statutory Timing

The EPA suggests that agencies should use the actual or statutory timing of rules to determine whether to include them in the baseline of an analysis when they are not sure which rules to include.[178] The guidelines proceed to suggest that the agency should perform sensitivity analysis on these estimates to help determine whether different rules or assumptions would change the results of their analysis. In a sense, this reflects an

176. For example, for ten rules, this implies each rule can be calculated with respect to $2^9 = 512$ baselines. This means that for ten rules, the total number of different CBA analyses is $10 \times 512 = 5120$ baselines.

177. The multiple baselines approach is thus incredibly sensitive to the choice of rules which are the focus of the study (for which the agency conducts analysis with those rules both in and not in the baseline). The current approach provides no discipline as to how those rules are chosen.

178. *See, e.g.*, EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130, at 5-12.

understanding that interdependencies—via the choice of baseline—affects the outcome of CBA estimation.

This method has the advantage of providing an easy method for resolving the problem of determining the appropriate baseline to use in the analysis of single rules. However, it may fail to account for relevant interdependencies because it leads to an arbitrary choice of baseline. In this approach, rules that come first in the timing are always part of the baseline for future rules. However, rules that came into effect earlier are not necessarily the most effective, and lead to inefficient path dependencies based on current agency agendas. As a result, though this approach reflects the real world strongly, it carries forward the regulatory environment's inefficiencies with it.

iv. Consideration of Cumulative Effects

The relatively recent Executive Order 13,563 and the subsequent OIRA memorandum instructed agencies to take measures to account for cumulative effects of regulation.[179] This is a directive to consider at least some interdependencies, since "cumulative" effects presumably are not captured by considering costs and benefits of single rules.

Unfortunately, the directive provided is only clear in that agencies must consider cumulative *costs* over many regulations.[180] Overlaps in the benefits of regulations, and particularly salient cost interdependencies in a small number of regulations likely remain unaccounted for in the "cumulative effects" instructions.

It is also unclear whether Executive Order 13,563 directs agencies to consider cumulative cost effects that entail positive interdependency. If the cost of multiple regulations is lower than the sum of costs of single regulations (i.e., if the marginal cost of compliance is decreasing), does the instruction of Exec. Order 13,563 specifically direct agencies to account for this? The answer seems to be no, as indicated by the language in Exec. Order 13,563 that communicates a concern about "redundant,

179. *See supra* Part I.D.

180. *Id*.

inconsistent, or overlapping" regulations.[181]

Therefore, while the consideration of cumulative effects reflects a growing consideration of interdependencies, it remains incomplete and unsuited to the nuanced and subtle ways in which interdependencies manifest in regulation. To that end, it cannot account for interdependency error in a satisfactory manner.

v. Retrospective Review

Retrospective review, discussed earlier,[182] is a process through which agencies review existing rules to see if they are still net beneficial given any changes that occurred since the rule was passed. While the content of retrospective review might depend—and indeed, we view some kind of retrospective review as important to the detection of interdependencies—the current version often consists of an agency simply conducting a fresh CBA on an existing rule, relative to a baseline that does not include the rule, or a baseline that does not include the group of rules currently under review.[183]

Apart from the fact that retrospective review catches interdependencies only well after rules have been enacted, this approach fails to solve for the interdependency problem for the same reason that the multiple baselines approach fails: it picks baselines arbitrarily.[184] That is, suppose that an agency passes rule A, then B, then C, and then conducts retrospective review of both relative to the baseline with only the other one. And suppose that interdependencies operate such that the optimal outcome is just passing C. In such a case, retrospective review might fail to identify this as the best outcome, since it would never compare the CBA estimate for B relative to a baseline with neither.[185] Retrospective review, in its current form, also fails to review

181. *See* Exec. Order No. 13,563.

182. *See supra* Part I.B.

183. *Id*.

184. Retrospective review also fails to adjust for reliance interdependencies since it occurs after the fact, *see supra* Part II.A.5.

185. For example, if the true ranking is such that C > A+B+C > A+C >< B + C, then retrospective review of each rule individually would lead to no changes, even though we would prefer to repeal rules A and B.

previously considered rules that were dismissed. It thus only corrects interdependency error when that correction leads to deregulation, giving it an inherent bias.[186]

D. Why haven't agencies developed a comprehensive approach?

The EPA's Guidelines for Preparing Economic Analyses is the only agency guideline we are aware of that recognizes interdependencies.[187] Across agencies, including the EPA, general practice is underdeveloped. This section attempts to offer some explanations as to why this may be the case and offers three major explanations: CBA is still new, resources are limited, and the Executive Branch's recognition of the problem has not translated into agency action. In the face of this analysis, we conclude by highlighting the need for a coherent framework to address these problems when they arise.

i. CBA is New and Developing

Executive Order 12,866 first ordered agencies to conduct CBA in 1983.[188] Agencies have spent the last thirty-seven years developing the institutional knowledge, data, and tools to conduct CBA. The federal government moves slowly, and agency deference historically has provided little need for agencies to quickly develop new approaches to CBA.[189] Much agency work over the years has been dedicated to solving relatively basic aspects of CBA such as quantifying cost and benefits (a task that is still far from complete) and working on data collection.[190] This

186. This critique has been made in the literature. *See*, *e.g.*, Michael A. Livermore & Jason A. Schwarz, *Unbalanced Retrospective Regulatory Review*, REG. REV. (July 12, 2012), http://www.regblog.org/2012/07/12-livermore-schwartz-review.html; Rena Steinzor, *The Real "Tsunami" in Federal Regulatory Policy*, CPRBLOG (May 22, 2014), http://www.progressivereform.org/CPRBlog.cfm?idBlog=2480725C-9CC8-717D-E8DE6C4C4A5FF6EB.

187. EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130.

188. *See supra* Part I.A

189. *See, e.g.*, Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc., 467 U.S. 837 (1984).

190. For examples of recent developments in CBA, *see* DAVID PEARCE ET AL., COST-BENEFIT ANALYSIS AND THE ENVIRONMENT: RECENT DEVELOPMENTS (2006).

problem is compounded by the variation in how agencies carry out CBA.[191] Overall, the evolution of single rule CBA has taken priority over considering more complex approaches.[192]

ii. Lack of Agency Resources and Data

Agencies have lacked resources and know-how to do basic, let alone complex CBA. Agencies historically lacked analytical rigor in developing cost-benefit models due to the lack of resources put to this task.[193] Executive orders have required agencies to analyze new and existing rules with CBA. However, agencies and commentators have listed numerous reasons why various aspects of regulatory analysis have been unsuccessful. These explanations include a lack of resources to conduct CBA, a lack of data, the lack of political incentives to properly evaluate existing regulations, political pressure, and agency momentum in passing new regulations instead of analytical rigor.[194] In particular, agencies facing resource constraints "satisfice" rather than optimize—they use their limited capacity to respond to the large number of demands on their time, rather than developing new approaches and tools.[195] Agencies are therefore ill-suited to develop better approaches to CBA.

191. *See, e.g.*, David W. Perkins & Maeve P. Carey, CONG. RESEARCH SERV., R44813, COST-BENEFIT ANALYSIS AND FINANCIAL REGULATOR RULEMAKING 9 (Apr. 12, 2017), https://fas.org/sgp/crs/misc/R44813.pdf.

192. In addition, some agencies have not developed complex CBA procedures because not all agencies frequently use CBA. This is partially because courts have ruled that the relevant statutory language does not permit the consideration of costs. *See, e.g., Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457 (2001). In other cases, it is that regulations do not have greater than $100 million of impact on the economy and are therefore not significant. *See* Exec. Order No. 12,866.

193. For the development of CBA, *see generally*, THOMAS O. MCGARITY, REINVENTING RATIONALITY THE ROLE OF REGULATORY ANALYSIS IN THE FEDERAL BUREAUCRACY (1992).

194. *See* Raso, *Assessing Regulatory Retrospective Review Under the Obama Administration, supra* note 66.

195. *See* Wendy E. Wagner, *Administrative Law, Filter Failure, and Information Capture*, 59 DUKE L.J. 1321, 1396 (2010).

iii. The Executive Branch's Recognition of the Problem has not Translated into Action

The idea of interdependencies was considered as early as 1993 in President Clinton's Executive Order.[196] However, we have only found one agency that is actively addressing the issue. The EPA has included a mandate to consider how their rules impact rules passed by other federal, state, and local agencies.[197] However, even despite this mandate, the EPA has not created a comprehensive approach to interdependencies. Most agencies' interdependency calculations are done in an ad-hoc manner which run the risk of being inefficient, prone to error, or skipped when difficult. The failure to apply a framework may lead to systematic biases and errors like the errors that arise in the absence of CBA.

Other approaches have attempted to approximate a solution to the interdependency problem. Circular A-4 orders agencies to examine the impact of comparing regulation to multiple baselines in order to understand the policy's range of outcomes and determine which assumptions are material.[198] Similarly, in 2017

196. President Clinton's executive order recognizes, without terming it such, cumulative effects as well as regulatory conflict. Exec. Order No. 12,866, *supra* note 32 ("Any views on any aspect of any agency plan, including whether any planned regulatory action might conflict with any other planned or existing regulation, impose any unintended consequences on the public, or confer any unclaimed benefits on the public, should be directed to the issuing agency, with a copy to OIRA.").

197. EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130, at 5-11 ("it is also necessary to determine how these other regulations [that are being considered by the agency] affect market conditions that directly influence the costs or the benefits associated with the policy of interest. This is true not only for multiple rules promulgated by EPA, but also for rules passed by other federal, state, and local agencies.").

198. OMB, CIRCULAR A-4, *supra* note 70, at 15. *See also* FRANK R. SPELLMAN, ECONOMICS FOR ENVIRONMENTAL PROFESSIONALS 85 (CRC Press 2015) (advocating for the use of multiple scenarios including those where rules interact. "Multiple baselines are needed, such as when it is impossible to make a reasonable unique description of the world in the absence of the proposed regulation. For example, if the current level of compliance with existing regulations is not known, then it may be necessary to compare the policy scenario to both a full compliance baseline and partial compliance baseline. Further, if the impact of other rules currently under consideration fundamentally affects the economic analysis of the rule being analyzed, then

the White House recommended continued use of multiple baseline analyses when doing analysis for regulations under Executive Order 12,866.[199] However, while the multiple baseline approach is a good starting point, and is currently being implemented by the EPA, it does not sufficiently deal with the issue of interdependencies.[200]

Ultimately, there is evidence that the Executive Branch has recognized the interdependency problem as significant. However, no coherent framework yet exists to approach this issue. This gap may exist due to inexperience, lack of political motivation, resource constraints, or simply a reluctance to mandate additional procedures. We acknowledge that individual rule CBA is currently difficult.[201] However, when significant regulatory action costs the United States billions of dollars each year, agencies should do better to address sources of significant error and incorporate the concerns of the Executive Branch.

multiple scenarios, with and without these rules in the baseline, may be necessary.").

199. *See* Memorandum from Dominic J. Mancini, Adm'r, OFFICE OF MGMT. & BUDGET, OFF. OF INFO. & REG. AFF, to Regulatory Policy Officers at Exec. Dep'ts and Agencies and Managing and Exec. Dirs. of Certain Agencies and Comm'ns, (Apr. 5, 2017) [hereinafter Mancini Memorandum] (ordering agencies to use multiple baseline analysis for CBA under EO 12,866 but only incremental analysis for EO 13,771) ("There are multiple Federal programs and policies—such as discharge general permitting under the Clean Water Act or Medicare quality performance tracking—that are updated or renewed at regular intervals via rulemaking. Because these updates reliably occur, an assessment of the incremental changes between the previous and updated programs is often much more informative than a comparison of the updated programs against hypothetical discontinuance. Although multiple-baseline analysis is likely to continue to be encouraged in such cases for analysis conducted under EO 12866, for purposes of EO 13,771, costs or cost savings should be determined by the incremental changes between previous and updated programs.").

200. *See supra* Part II.C.2 (discussing multiple baselines).

201. The difficulty and complexity in single rule CBA have led critics to compare agency rulemaking proposals to advocacy statements rather than true analysis. Ellig, *supra* note 101, at 9 (criticizing current agency approaches to regulatory impact analysis) ("Regulatory impact analyses sometimes seem to be advocacy documents written to justify decisions that were already made, rather than information that helped regulators determine what to do.").

E. Legal support for addressing interdependencies

The current legal requirements placed upon agencies support the proposition that agencies must consider significant interdependencies in their CBA. Beyond the general policy arguments[202] and the requirement to use best practices available, there are specific provisions that support the systematic analysis of interdependencies by agencies.

Circular A-4's requirement to use multiple baselines fully supports this paper's proposal for MCBA.[203] A-4 was concerned about the sensitivity of CBA to assumptions about baselines. Assumptions about other rules, as shown, matter in this sense. Circular A-4 also requires that agencies consider second and third-order effects.[204] As discussed in this paper, an important second and third-order effect is that a rule can affect the efficacy of other rules. Therefore, Circular A-4 provides legal support for CBA analysis.

Similarly, Executive Order 13,563 and the Sunstein Memorandum provides support for the notion that agencies must consider the cumulative cost effects of regulations.[205] At the very least, those two documents instruct that agencies must consider, where possible, negative interdependencies in rule costs between large numbers of rules where possible.[206] Whether there is support for other types of interdependency is less clear, but at the least there is support for interdependency analysis by analogy. Interdependencies might mean something broader than "cumulative effects," but similarly confound simple CBA estimates, and so should similarly be considered by agencies.

The increasing shift towards retrospective review also provides legal support for a systematic analysis of interdependencies. One of the concerns behind retrospective review is that changes in circumstances might alter the effectiveness of a rule. Changes in the regulatory landscape qualify as such a change in landscape. If a good rule is no longer

202. *See supra* Part I.D.
203. *Id*.
204. *Id*.
205. *See* Exec. Order No. 13,563; *see* Sunstein Memorandum, *supra* note 86.
206. *See supra* Part I.D.

creating net benefits because an inefficient rule is limiting its effectiveness, then agencies should consider taking steps to understand this before eliminating the rule outright. Therefore, retrospective review provides strong, albeit indirect, support for analysis of interdependencies.

PART III. MULTIPLE-RULE COST-BENEFIT ANALYSIS

Despite the pervasive and complex issue of interdependencies, agencies can take steps to effectively address these issues and avoid interdependency error. We propose that agencies adopt "Multiple-Rule Cost-Benefit Analysis" (MCBA).[207] For our purposes, we define "Multiple-Rule Cost-Benefit Analysis" as the explicit analysis of cost and benefit interdependencies between rules, at a systematic level, by an agency. While we do not sketch out an exhaustive approach in this paper, we suggest that a tiered, disciplined MCBA approach would look as follows: first, an agency determines which combinations of rules it needs to analyze together based on high levels of interdependencies. Then, an agency must be able to conduct CBA on this group of rules accurately and with clear assumptions. This can be as straightforward as adding the net benefits of the rules individually, and then adding and subtracting interdependent costs and benefits.

This section of the paper considers how agencies might take first steps to develop MCBA procedures. How individual agencies implement procedures for conducting CBA is beyond the scope of this paper since it will depend on the agency's personnel, resources, expertise, regulatory burden, industry, and other areas. However, while we do not prescribe specific approaches, we do suggest principles and helpful tools that can be used to develop new procedures or to be integrated into existing procedures, such as multiple baseline CBA or some modification of the combining rules approach.

We begin this section by discussing why agencies need a deliberate approach when conducting CBA on multiple rules. We

207. Alternatively, one could use the acronym "MRCBA." We prefer MCBA because it is shorter and could be taken to stand for "Multi-rule Cost-Benefit Analysis" or "Multiple Cost-Benefit Analysis."

then lay out broad principles to follow when designing these procedures. We propose tools that can assist agencies in conducting MCBA. We will then respond to likely objections to this approach. Finally, we will compare this approach to regulatory budgets, a recent executive directive that attempts to address unaccounted-for cumulative effects of rules.

A. The need for a Deliberate Approach—the Curse of Dimensionality[208]

Agencies need a disciplined way of dealing with the problem of interdependencies because it is not possible to exhaustively conduct MCBA on combinations of rules. Ideally, an agency can identify maximum net benefits if they conduct CBA on every possible combination of rules. Indeed, without making further assumptions on the structures of interdependencies, this is the *only* way to exhaustively account for interdependencies. For example, if an agency is considering three rules, A, B, and C, an exhaustive analysis would involve doing CBA on A, B, C, A+B, B+C, A+C and A+B+C. This identifies every possible way that a combination of rules together could create an interdependency. However, this analysis quickly becomes untenable when considering larger numbers of rules. For N rules, the number of possible combinations of rules is 2^N and the number of analyses needed to be conducted is 2^N-1.[209] For three rules, as above, the number of possible combinations is 7. For five rules, that number is 31. For ten rules, it is 1023. Very rapidly, the number becomes too large for agencies to keep track. It is not feasible for an agency to run CBA analysis 1023 times if it is considering ten rules that have interdependent effects.

208. "The Curse of Dimensionality" was coined by Richard Bellman in 1957. *See* RICHARD E. BELLMAN, DYNAMIC PROGRAMMING ix (1957). The Oxford Dictionary of Economics defines it as a situation where "mathematical models can rapidly become excessively difficult to analyze as the number of variables increases." A DICTIONARY OF ECONOMICS (John Black, Nigar Hashimzade, & Gareth Myles eds., 4th ed. 2012).

209. In mathematics, the set of every possible combination of items in a set A is called the powerset of A. The size of the powerset is 2^N, where N is the size of set A. However, the powerset contains the empty set, which we do not need to consider here as a "combination of rules."

As a result, agencies must decide which analyses are worth conducting. However, even determining which subset of analyses to conduct is not a trivial problem. There are 2^N-1 possible CBA analyses that an agency can conduct on a set of N rules. However, before it gets there, an agency has the problem of picking the proper interdependent subset from its set of possible rule combinations. Call such a subset a "framework." Each framework is essentially a choice about how to narrow down the decision-making burden. For example, CBA as it currently is, instructs us to always choose the framework that estimates the net benefits of rules individually and only individually. The number of possible such frameworks—each one a set of combinations of interdependent rules—is staggering. Since there are 2^N-1 rule combinations to run the analysis on, there are 2^{2^N-1} possible frameworks. As N increases, this quickly becomes a truly monstrous number. The problem of how an agency identifies the correct framework for analysis from the sea of possibilities is a real one.

Without a deliberate approach, using a framework that tests too many possible combinations could easily consume an agency's entire budget. Allowing agencies to be too selective, on the other hand, opens the door to interdependency error and manipulation. To address this problem, we have developed a set of heuristics based on algorithm development in other fields facing the same difficulty.[210] Before examining tools that agencies can use to

210. Methods to counter the curse of dimensionality have developed frequently in fields that rely on complex algorithm creation. *See, e.g.*, Andrew Curtis & Anthony Lomax, *Prior Information, Sampling Distributions and the Curse of Dimensionality*, 66 GEOPHYSICS 2, 372 (2001) (discussing methods of circumventing the curse of dimensionality in sampling distributions in Bayesian inversions); Wei Kang & Lucas C. Wilcox, *Mitigating the Curse of Dimensionality: Sparse Grid Characteristics Method for Optimal Feedback Control and HJB Equations*, 68 COMPUTATIONAL OPTIMIZATION APPLICATIONS 289, 290 (2017) (discussing the curse of dimensionality in computational optimization); Viktor Minschel & Markus Kratzig, *Solving, Estimating, and Selecting Nonlinear Dynamic Models Without the Curse of Dimensionality*, 78 ECONOMETRICA 803 (2010) (discussing the methods to escape the curse of dimensionality in econometrics); Francis Bach, *Breaking the Curse of Dimensionality with Convex Neural Networks*, 18 J. MACHINE LEARNING RES. 1 (2017) (recognizing and attempting to circumvent the curse of dimensionality in AI).

address interdependencies, we first discuss principles that should guide any MCBA procedure.

B. Principles of an MCBA Approach

The failure of existing solutions to present satisfactory answers to the interdependency problem requires the development of a new approach. This Article will proffer principles to guide the conduct of Multiple-Rule Cost-Benefit Analysis (MCBA). Because the number of possible MCBA frameworks (subsets on which to conduct CBA) is staggeringly large, any offered framework will most likely involve some arbitrary decision over other frameworks. Therefore, before discussing specific tools and approaches to tackle the interdependency problem, we will discuss important principles on which to base any approach to MCBA.

Principle I: MCBA approaches must recognize agencies' limited resources

It might be that carrying out cost-benefit analysis is cheap and the number of rules being considered are not high. In such a case, it may be feasible to carry out cost-benefit analysis on not just every rule individually but every possible combination of feasible rules. Indeed, if CBA analysis is costless, this is optimal, since an agency will have all possible information, and can then choose the combination of rules that yielded the highest net benefit. However, understanding that there are constraints on CBA in practice means that agencies have to identify a subset of rule combinations to analyze.

Principle II: Agencies should explicitly recognize assumptions

An agency's initial beliefs about the efficacy of rules and their interdependencies are highly relevant. If an agency is constrained by resources when conducting CBA and cannot conduct CBA on every possible combination of rules, then it needs to make reasoned decisions regarding which combinations to carry out CBA. An agency's prior beliefs about the occurrence and magnitude of interdependencies—those beliefs it holds before it carries out any detailed economic analysis—will inform the

choice of initial cost-benefit analyses and inform how the results of these initial analyses are used. Ultimately, given limits on agency resources, these initial assumptions and beliefs will be profoundly influential on final agency decisions. As a result, agencies should try to be explicit and disciplined in laying out these initial beliefs. One way to do this is to assign expected probabilities to outcomes.

Understanding agency decision-making from the 'Bayesian' point of view is instructive here. Bayesian inference provides a framework for how a decision-maker should change their beliefs rationally when presented with new information.[211] In Bayesian statistical inference, a statistician assigns a probability to an event, and then updates that probability as he or she observes data. The probability assigned before observing the data is called the prior probability, or prior belief. The probability after updating is referred to as the posterior probability or belief. To make such reasoned decisions, an agency should assign prior probabilities to certain outcomes, such as the existence of interdependencies. If an agency has a lot of information, the prior belief is less relevant to the agency's posterior—their final beliefs. However, given the complexity created by potential interdependencies, and the likely lack of conclusive data out there to resolve uncertainty about such interdependencies, an agency's prior beliefs (and assumptions) become much more determinative of their final beliefs. Therefore, initial beliefs are important to understanding an agency decision, and they should be made explicit. In practice, this approach need not happen in the formal method prescribed by decision theory. However, making an explicit statement of the agency's initial beliefs or assumptions and explaining them would help agencies develop more consistent approaches and would help to hold them accountable.

211. Bayesian inference is the dominant model for "rational" beliefs as analyzed by decision-theorists. *See generally* GIOVANNI PARMIGIANI & LURDES Y.T. INOUE WITH HEDIBERT F. LOPES, DECISION THEORY: PRINCIPLES AND APPROACHES (2009). One of the most powerful arguments for the rationality of Bayesian rules of inference is the "Dutch Book argument", which shows that a decision-maker who does not follow Bayesian rules of inference loses money when forced to make bets at the odds implied by those rules. *Id*. at 17–24.

Principle III: Agencies should design deliberate approaches to choose the timing of analysis in MCBA

Agencies need to take a disciplined approach regarding the order in which multi-rule CBA is conducted. Initial CBA analyses can yield information about which further CBA analyses with which an agency should proceed. Suppose an agency is examining two rules, A and B, but is concerned about interdependency between them. Suppose further that an agency carries out CBA on rule A, and finds that the CBA value is highly negative, meaning that regardless of interdependencies it will most likely not promulgate A. Then, a CBA analysis on both A and B together is not necessary, and the agency can just carry out CBA analysis on B alone.

However, this further complicates analysis of MCBA. Instead of merely considering which rules to carry out CBA on, a good approach needs to have conditional steps. In the above framework, the steps might be (where X represents a threshold number chosen by the agency).

1. Conduct CBA on rule A.
2. If CBA on rule A < -X, we know we won't pass A, conduct CBA on B
3. If CBA on rule A > X, we know we will pass A, conduct CBA on A&B
4. If CBA on rule X > A > -X, we might pass A alone or with B, conduct CBA on B and on A&B

In the above example, step 2 is reached if an agency finds that A is unlikely to produce benefits (even considering positive interdependency), whereas step 3 is reached if A is highly likely to produce benefits. By contrast, the final step, step 4, is reached if we are unsure whether Rule A is going to produce benefits. In such a case, conducting CBA on both B and A&B is important to determining which rules an agency should pass. Ultimately, well developed decision trees will assist agencies to determine the best order in which to conduct their analysis. This directly leads to a number of related sub-principles below.

Principle IIIA: If CBA on an individual rule is highly negative, an agency can strike that rule from the considered set of rules for the purpose of future MCBA

If CBA on an individual rule yields a highly negative figure, then interdependencies are unlikely to change the analysis, and an agency will be highly unlikely to pass or maintain that rule. In such a case, an agency should not consider that rule in further analysis and should not feature that rule in any combinations of rules on which it carries out CBA analysis.

Principle IIIB: If CBA on an individual rule is highly positive, an agency can include that rule as part of a combination of rules in all future CBA analyses

If a rule has significant net beneficial outcomes, then an agency should not carry out CBA on any combination of rules that does not include that particular rule. Because this rule is likely to be passed or maintained, carrying out CBA without this rule would amount to ignoring a significant part of the regulatory environment. As a result, the new rule should always be included in future analysis.

Principle IV: MCBA should be applied retrospectively

Executive Orders and other policies already require retrospective review.[212] One goal of retrospective review is for an agency to affirm or reject prior CBA estimates. Agencies should also use retrospective review to identify interdependencies involving rules already promulgated. MCBA should not just be adopted to analyze new rules and their interdependencies with each other, but should also be used to look back and see how

212. Since President Clinton, every President has called for retrospective review of existing regulations to assess their continued effectiveness. However, President Obama was the first President to make it a significant priority. Retrospective analysis inherently requires that agency check their previous CBA estimates against their true impact and against changed market conditions. *See* Executive Order 12,866 (under President Clinton); Exec. Order No. 13,563 at § 6 (under President Obama); Exec. Order No. 13,610, 77 Fed. Reg. 28469 (May 10, 2012) (under President Obama); Exec. No. Order 13,771 (under President Trump).

missed MCBA analysis has led to sub-optimal rulemaking in the past. While, as discussed, current retrospective review procedures are inadequate to address interdependency error,[213] MCBA principles applied retrospectively could be hugely effective. In so doing, retrospective MCBA might allow agencies to correct for interdependency error without needlessly delaying regulations that are needed quickly, and with the benefit of additional information learned over time. Finally, retrospective application of MCBA should also be used to analyze interdependencies between new rules and rules that were previously considered but not promulgated.

Finally, it is worth noting that retrospective review might plausibly be the most effective way to assess macro-interdependencies. Most individual rules alone do not create significant interdependencies. As a result, agencies may have a hard time identifying macro-interdependencies in advance, and they may become clear only upon retrospective review. If an agency's retrospective CBA estimate for a large group of rules significantly differs from the sum of its individual CBA estimates, it suggests that there might be macro-interdependencies at play. After understanding this, agencies can take additional steps to identify interdependencies.

Principle V: Any approach should be adaptable

Agencies should adjust their approach based on their resources, the regulatory context, their experiences, and the experiences of other agencies. Without first-hand experience, agencies will have a difficult time determining when increased scrutiny of rule interdependency improves regulatory outcomes. Questions regarding the frequency with which to conduct CBA estimates or when to expect interdependencies between subsets of rules are inherently empirical in nature. Agencies will become better at answering them with practice. Any approach should leave space for agencies to learn about and improve their procedures.

With standard CBA analysis, it is normal for the Office of

213. *See supra* Part II.C.5.

Information and Regulatory Affairs to issue memos about "best practices" for CBA analysis.[214] A similar approach should prevail in adopting any new MCBA procedures. OIRA should gather information from agencies about their practices, about what is working, and use this to craft agency-wide best practices for any new approach.[215]

Principle VI: Approaches should use abbreviated analysis when appropriate

Agencies will have to use abbreviated analysis—more informal economic analysis that makes more assumptions, costing accuracy but reducing time and resource costs—based on previous CBA results to streamline their process.[216] Much of the subsequent discussion treats CBA of combinations of rules as separate analyses in their own right. However, in cases with small interdependence effects, traditional CBA results can be

214. *See, e.g.*, Mancini Memorandum, *supra* note 199; OFF. OF INFO. & REG. AFF., AGENCY CHECKLIST: REGULATORY IMPACT ANALYSIS (Oct. 28, 2010) https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/regpol/RIA_Checklist.pdf; Memorandum from Cass R. Sunstein, Adm'r, OFFICE OF MGMT. & BUDGET, Exec. Order 13,565, Improving Regulation and Regulatory Review, to Heads of Exec. Dep'ts and Agencies and of Indep. Reg. Agencies (Feb. 2, 2011); OFF. OF INFO. & REG. AFF., REGULATORY IMPACT ANALYSIS: FREQUENTLY ASKED QUESTIONS (FAQS) (Feb. 7, 2011), https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf; OFF. OF INFO. & REG. AFF., REGULATORY IMPACT ANALYSIS: A PRIMER (Aug. 15, 2011), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf; TREASURY AND OMB IMPLEMENTATION OF EXEC. ORDER 12291, MEMORANDUM OF AGREEMENT BETWEEN THE DEPARTMENT OF THE TREASURY AND THE OFF. OF INFO. & REG. AFF. (Apr. 29, 1983) https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/memos/2016/omb_moa_83_93.pdf.

215. This is already being done in for traditional CBA to great effect. Continuing this for new approaches to handling multiple rules would have similar significant benefits.

216. This would be a contrast to traditional CBA analyses, which can be incredibly long, stretching for thousands of pages. *See e.g.*, OCCUPATIONAL SAFETY & HEALTH ADMIN., PRELIMINARY ECONOMIC ANALYSIS AND INITIAL REGULATORY FLEXIBILITY ANALYSIS, *supra* note 149; *see generally* EDWARD C. F. WILSON, A PRACTICAL GUIDE TO VALUE OF INFORMATION ANALYSIS, PHARMACOECONOMICS (2015).

used to construct additional estimates or additional estimates may be unnecessary.

First, initial CBA analysis might vastly reduce the amount of work needed for future CBA analyses. Suppose that an agency is looking to analyze two rules, A and B. An agency conducts initial analyses on rules A and rules B, and then looks to conduct analysis on A+B. Analysis on A+B might require much less procedure than that of either A or B, because components of the initial estimates can be reused for the third analysis. Mostly, an agency can focus on those parts of the analysis that it expects to be different, namely second-order effects, market effects, noted similarities in control technologies, or shared benefits.

Moreover, explicit modeling interdependent variables (using curves instead of pointwise values) will remove the need for additional CBA analyses altogether. For example, the social cost of carbon is better modeled by a curve than by a pointwise estimate. An agency which explicitly models the cost of carbon curve will be able to assess the interdependencies between carbon-emission targeting rules merely by reference to the amount by which they reduce carbon.[217] Often, explicitly modeling the non-linearity of shared benefits or market effects of a lot of rules will allow for interdependencies to be assessed more quickly.

C. Tools for MCBA

Now that we have reviewed the principles that a CBA approach should include, we identify tools useful to agencies that try to conduct MCBA. It is important to note that the intention of this paper is not to provide an exhaustive framework for analysis. On the contrary, it is probably sub-optimal to have a procedure that is rigid too early into the exploration of interdependencies. Agencies should adapt their approaches as they go along. Internal studies can also be very helpful in determining when interdependencies *generally* occur. Nonetheless, the techniques offered below offer a first

217. Assuming that this is the only interdependency they have. Even if it is not, this will be a significant component of the regulations' total interdependencies.

approximation of an MCBA approach that can used alone or in combination with existing approaches such as rule combinations or multiple baselines. The aim is to discipline agency decision-making, particularly in the initial step.

i. Tool 1 — Rule Interdependency Matrices[218]

To understand pairwise interdependencies—interdependencies between pairs of rules—an agency should, before conducting rigorous analysis, produce a matrix that identifies prior expectations about interdependencies between rules. Decision-makers in the private sector have often used a similar tool—the Design Structure Matrix—in making decisions when they are concerned about interdependencies between those decisions. Here, in an interdependency matrix, the rows and columns denote the rules in consideration. Each cell of the matrix then denotes whether an interdependency exists between the row and column rules. In some cases, an agency might be unsure as to the type of interdependency. In this case, the matrix cell should simply indicate that an agency expects to find an interdependency, without specifying what kind.

	Rule A	**Rule B**	**Rule C**
Rule A		High negative interdependency	High positive interdependency
Rule B			Low negative interdependency
Rule C			

To predict interdependences and fill in the matrix, agencies

218. The idea of an interdependency matrix is taken from the concept of a Design Structure Matrix from the fields of engineering systems and project management. It is a network modeling tool used to represent the elements comprising a system and their interactions, and as a result, highlighting the system architecture. They are used to help people better design develop and manage complex engineered systems. *See generally* STEVEN D. EPPINGER AND TYSON R. BROWNING, DESIGN STRUCTURE MATRIX METHODS AND APPLICATIONS (MIT Press 2012).

could also conduct a qualitative analysis. Agencies should be able to determine theoretical interdependencies before they conduct any analysis by looking at relevant features of the rule. These include the nature of the regulatory action, shared regulated entities, potential similarities in the means by which agencies achieve compliance, general market conditions, and similarities in second-order effects. As an example, consider the EPA's stated example of the CAIR and CAMR regulations. In that case, CAIR's control technology needed to reduce emissions affected the ultimate incremental value of CAMR. These agencies could identify this interdependency in advance by recognizing that the relevant technology needed for CAIR compliance affects mercury levels.[219] Agencies should also look to shared anticipated benefits. For example, if both rules aim to reduce carbon emissions, it is likelier that interdependencies will exist as a matter of priors.

This matrix can also help agencies identify "clusters"—groups of rules that have many interdependencies within the group but have almost no interdependencies with rules outside the group. The agency can then treat each group separately. Since the number of possible analyses grows exponentially with the number of rules in a group, agencies can use this to find the smallest possible groups of rules to consider to successfully analyze interdependencies.

As agencies get more information, they can update their interdependency matrices. For example, an agency can construct an interdependency matrix after it has constructed an analysis of expected pairwise interdependencies. Agencies could then supplement, modify, or delete cell values as necessary as their understanding of their regulations evolves.[220]

219. The EPA recognizes that regulations targeting particulate matter have the additional benefit of reducing the emissions of hazardous pollutants. *See* U.S. ENVTL. PROTECTION AGENCY, OFF. OF AIR & RADIATION, REGULATORY IMPACT ANALYSIS FOR THE FINAL CLEAN AIR INTERSTATE RULE, EPA-452 (Mar. 2005) (identifying significant unquantified benefits in CAIR including increased crop yields, improved visibility, and health and welfare benefits associate with reduced mercury emissions).

220. The EPA did something similar when it conducted its regulatory impact analysis for the Clean Air Mercury Rule. It recognized that CAIR had a significant impact already in reducing mercury levels and therefore eliminated used a 'zero-out scenario' when conducting CBA on CAMR. ENVTL. PROTECTION

ii. Tool 2 — Agency Commonality Lists

To discipline agency decision-making, agencies can record and track those benefits and costs that are most likely to be shared both within and across agencies. One approach to this includes listing the rules that intend to regulate certain areas and identify internal and external agency rules that have similar intent. This will help agencies develop intra and inter-agency linkages and contextualize the regulatory environment in which a rule operates. Like other rules suggested in this paper, agencies can construct this list at any time and update it as their understanding of the regulatory environment and rules' impact evolve. A basic design for this table is shown below.

Effect	**Rules**
Reduced Mercury Emissions	CAMR, CAIR
Reduced Carbon Emissions	Greenhouse emissions rule, Vehicle emissions rule
Increased Interest Rates	Lending rule, Mortgage disclosure rule
HR Training for Compliance	Rules A–M

iii. Tool 3 — Rule Rankings

Rule rankings can provide an agency with a method to determine the combinations of rules on which to carry out CBA. In accordance with Principle IIIA and IIIB above, agencies can use Rule Rankings to help them identify rules that are so net-beneficial or net-costly that they should either feature or not feature in all future baselines. An agency will seek to carry out "rounds" of estimation. After each round, the rules with CBA estimates above some threshold then feature in all future rule combinations. Similarly, rules with a CBA estimate below a

AGENCY, OFF. OF AIR & RADIATION, REGULATORY IMPACT ANALYSIS FOR THE FINAL CLEAN AIR INTERSTATE RULE, *supra* note 219, at 3-24.

chosen threshold are removed. As agencies iterate this procedure, more and more rules are added or removed from combinations iteratively until an agency cannot narrow down the set of remaining rules anymore. Agencies can then conduct multiple rule analysis with these baselines.

The exact means by which MCBA will be carried out may vary, but an example is given in the figure below. An agency identifies the rules it believes has the most net benefits and thereby has the highest chance to be passed or retained. It then carries out CBA on the highest ranked rule individually. If that rule yields high enough CBA benefits,[221] it is used in all future CBA combinations. Meanwhile, if a rule has negative or near-zero positive results, then an agency might choose to retain that rule in future analyses to test its interdependencies, or else discard it. In the example below, all CBAs feature Rule A as part of its baseline in round 2. Agencies repeat this procedure with Rule B, including Rule A as part of a baseline.

More complex analyses might feature more rounds, or more complex decision-making after each round for rules' retention or elimination. For example, agencies might vary the threshold which determines whether a rule is featured in future combinations on the basis of information outside of estimated net benefits, such as that found in an interdependency matrix.

<table>
<tr><th></th><th>Pre-Estimation</th><th></th><th>Post Initial Estimation</th><th></th><th>Post Final Estimation</th></tr>
<tr><td>Most likely to be passed</td><td>Rule A</td><td rowspan="3">Round 1: Carry out CBA on Rule A</td><td>Rule A</td><td rowspan="3">Round 2: CBA on Rule A+B, CBA on Rule A+C</td><td>Rule A</td></tr>
<tr><td></td><td>Rule B</td><td>Rule B</td><td>Rule B</td></tr>
<tr><td>Least likely to be passed</td><td>Rule C</td><td>Rule C</td><td>Rule C</td></tr>
</table>

221. How this threshold is determined is beyond the scope of this paper. The threshold should generally be decided by an exercise of agency judgment.

iv. Tool 4 — Formal Modeling Using Priors

All of the above techniques are useful heuristic techniques. However, an agency might have the resources and capability to test more sophisticated analysis that leads to a more accurate or precise result. For example, imagine that an agency has a number of iterative approaches to selecting and analyzing rules, like the Rule Ranking above, but it doesn't know which approach works best. Agencies can develop simulations of the world based on its initial beliefs about how rules under consideration interact with each other.[222] These simulations will estimate the net benefit of every combination of rules under consideration. Agencies can then test their various iterative approaches with each simulations' net benefits to see which approach is most effective. Future academic study should also be able to identify those iterative CBA algorithms that are most likely to identify optimal combinations of rules in practice.

D. Responses to Objections

This section anticipates possible objections to MCBA. Of course, every approach in a world with finite resources will have flaws, and our approach is no different.

i. MCBA achieves very marginal gains

Opponents might argue that MCBA achieves very marginal improvements on CBA, which is already meant only as a rough heuristic for decision-making. CBA has been widely criticized for struggling to properly account for and quantify costs and benefits, and has been defended by many as merely a "rough and ready proxy" for welfare.[223] As a result, adding additional procedures to make estimates more 'accurate' may not only fail to

222. One technique an agency might use is Monte-Carlo simulation. Agencies in some cases already use Monte-Carlo to aid in CBA, *see, e.g.,* EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130, at 7-5. For an explanation of Monte-Carlo, *see* CHRISTIAN ROBERT & GEORGE CASELLA, MONTE CARLO STATISTICAL METHODS (Springer-Verlag 2009).

223. *See* MATTHEW D. ADLER & ERIC A. POSNER, NEW FOUNDATIONS OF COST-BENEFIT ANALYSIS 25 (Harvard Univ. Press 2006).

do this, but also have unintentional negative effects. First, it may entrench CBA by making CBA estimates look more scientific and accurate while creating more uncertainty and obscuring the many assumptions and inaccuracies that the net benefit estimate contains. Second, adding this additional procedure may undermine the purpose of CBA to guard against obvious biases and errors in reasoning.[224]

However, we believe that today, agencies use CBA in a precise fashion, and not only to check major errors in judgement.[225] It may be the case that previously CBA was used as a sanity check,[226] but it provides more benefits today as technology and methodology have evolved. While some agencies may only rely on CBA to develop broad judgement checks with difficult-to-quantify costs and benefits, most agencies look to develop precise numbers. This is truer than ever now that agencies regularly report to OIRA and adhere to regulatory budgets. Moreover, addressing interdependencies through MCBA addresses a systematic, rather than just analytical or computational error, which might cancel out over a large number or regulations. By contrast, interdependencies are likely systematic errors because they will lead to systematic over- or under-regulation across the board.[227] Therefore, accounting for

224. *See, e.g.*, Cass R. Sunstein, *Is Cost-Benefit Analysis for Everyone?*, 53 ADMIN. L. REV. 299, 303 (2001).

225. There are many examples of this. Consider the use of multiple means of measuring mortality risk, *see* EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130, at 7-10, linear programming methods for determining compliance costs, *id.* at 8-16, or use of revealed preference methods for estimating benefits, *id.* at 7-21. Amy Sinden also argues that CBA as currently practiced is far more formal than the idea of CBA as a rough decision-making heuristic, *see* Amy Sinden, *Formality and Informality in Cost-Benefit Analysis*, 93 UTAH L. REV. 95 (2015).

226. *See, e.g.*, SALONI RAMAKRISHNA, ENTERPRISE COMPLIANCE RISK MANAGEMENT: AN ESSENTIAL TOOLKIT FOR BANKS AND FINANCIAL SERVICES (John Wiley & Sons Singapore Pte. Ltd. 2015) (calling for CBA in regulatory analysis as an azimuth check) ("Cost-benefit analysis, both by the regulators and the regulated, is a sanity check that will help evolve an optimal approach to address areas of concern.").

227. It is beyond the scope of this Article to say precisely whether it leads to over or under regulation since this paper focuses on increasing net benefits. However, over regulation by some agencies and under regulation by others likely does not balance out because of the nature of interdependencies, size

interdependencies with an MCBA approach will eliminate a systematic error and will discipline thinking much in the same way that CBA itself aims to discipline thinking.

ii. MCBA increases procedural burdens on already overworked agencies

Moreover, the additional costs of further procedure might be prohibitively high and may further ossify administrative law. Some authors have pointed out that CBA is already too resource intensive and not a high enough priority to be done correctly.[228] At least one congressional research report on CBA writes that "requirements to perform such [cost-benefit] analyses may restrict agencies from effectively regulating."[229] Even strong proponents of CBA have regularly taken issue with the difficulties in involved in doing traditional analysis.[230] These costs may be prohibitive in conducting good analysis and have the potential to contribute to the ossification of administrative law,[231] assuming one accepts the premise that administrative law

differences across agencies, and systematic trends across government.

228. *See* Raso, *Assessing Regulatory Retrospective Review Under the Obama Administration*, *supra* note 66. *See also* Richard J. Pierce, Jr., *Seven Ways to Deossify Agency Rulemaking*, 47 ADMIN. L. REV. 59, 62 (1995) (arguing that procedures, such as CBA, required for major rules is ossifying agency rulemaking).

229. *See* Perkins & Carey, CONG. RESEARCH SERV., *supra* note 191, at 3.

230. Cass Sunstein has been writing about difficulties involved in CBA for over two decades. *Compare* Cass R. Sunstein, *Congress, Constitutional Moments, and the Cost-Benefit State,* 48 STAN. L. REV. 247 (1996) (recognizing difficulties in quantifying costs and benefits, priority setting, and regulatory analysis) *with* Cass R. Sunstein, *'They Ruined Popcorn': On the Costs and Benefits of Mandatory Labels* (Harvard Pub. L. Working Paper No. 18-06, 2018) (discussing the normative, conceptual, and empirical challenges in collecting information on the costs and benefits of mandatory labeling). A very topical article on this topic by Professor Sunstein is Cass R. Sunstein and Robert W. Hahn, *A New Executive Order for Improving Federal Regulation? Deeper and Wider Cost-Benefit Analysis* (John M. Olin Program in L. and Econ. Working Paper No. 150, 2002) (discussing the difficulties that exist in cost-benefit analysis).

231. "Ossification of the rulemaking process" was a term coined by Thomas McGarity describing the challenges agencies face passing regulation. *See* Thomas O. McGarity, *Some Thoughts on "Deossifying" The Rulemaking Process,* 41 DUKE L.J. 1385, 1435 (1992).

has ossified or that it is a bad thing.[232] MCBA would only add to these time and resource costs, and would exacerbate these problems.

While ossification may be a problem, conducting MCBA will not lead to increased ossification. The procedures proposed in this paper are internal agency approaches that can be conducted in parallel with other procedures to avoid time delays. Moreover, there are many sources of ossification beyond CBA. Academic literature has pointed to judicial, congressional, and administrative reasons for ossification.[233] The notice and comment process is often cited as the most difficult burden to overcome.[234] Relative to the existing processes in place, it may be that the additional step of carrying out CBA on combinations of rules is relatively simple. In fact, the changes that we suggest may not be procedurally more complex than minor adjustments that agencies regularly make.[235]

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232. Ossification may help agencies pass and retain good laws. *See* Aaron L. Nielson, *Optimal Ossification*, 88 GEO. WASH. L. REV. 1493 (2018), http://www.gwlr.org/wp-content/uploads/2012/07/80_5_4_Pierce.pdf (reframing ossification as an opportunity to make sure that a rule maximizes its intended benefits); Stuart Shapiro, *Embracing Ossification*, REGULATION (2018–2019) (discussing how pro-regulation individuals are relying on ossification to preserve important regulations against the pressure to deregulate). Other work questions the existence of ossification altogether. *See* Jason Webb Yackee & Susan Webb Yackee, *Testing the Ossification Thesis: An Empirical Examination of Federal Regulatory Volume and Speed, 1950-1990*, 80 GEO. WASH. L. REV. 144 (2012) (arguing that there is no empirical support for the ossification hypothesis); *but see* Richard J. Pierce, Jr. *Rulemaking Ossification is Real: A Response to* Testing the Ossification Thesis, 80 GEO. WASH. L. REV. 1493 (2012) (arguing that the Yackee and Yackee paper fails to undermine or contradict the ossification hypothesis).

233. For an in-depth discussion of the history and various explanations of ossification, *see* Yackee & Yackee, *Testing the Ossification Thesis: An Empirical Examination of Federal Regulatory Volume and Speed, 1950-1990, supra* note 233, at 1423–35.

234. *See* McGarity, *Some Thoughts on "Deossifying" the Rulemaking Process, supra* note 231, at 1427–28.

235. For example, in 2011 the Department of Health and Human Services (HHS) was asked to create an agency-wide Analytics Team designed to provide recommendations to strengthen their regulatory analysis. This resulted in the HHS Guidelines for Regulatory Impact Analysis which, among other things, implemented more rigorous analytical standards and leveraged economic and analytical expertise across the department. *See* U.S. DEP'T OF HEALTH & HUMAN SERV., GUIDELINES FOR REGULATORY ANALYSIS (2016). Similarly, the EPA-

Finally, it is worth pointing out that if a procedure is too burdensome an agency is likely simply not to follow it.[236] Agencies will maintain some discretion over when to use MCBA, meaning that in cases where it would be too burdensome, there will be a good reason not to use it.

iii. Increased Agency Discretion

It could be claimed that MCBA might allow agencies to manipulate the process to their benefit. The existence of interdependencies implies that cost-benefit analysis is fraught with greater uncertainty than would otherwise exist. In such an uncertain environment, an agency's initial assumptions—which can often reflect values or politics—can have a significant impact on whether the agency ultimately decides a regulation is a good idea. It is possible that agencies could use interdependencies to justify incorrectly passing regulation. For example, an agency

NHTSA formally began documenting and using learning curve-based cost adjustments in their regulatory impact analysis since 1997. The learning rate was initially set at 20%, but over time the EPA and NHTSA began using multiple learning rates based on whether technologies were newer or more mature. Similarly, the Department of Energy adopted a whole-product learning curve-based price adjustment approach to their CBA beginning in 2011. For an in-depth discussion of how these agencies have changed their practices over time, see Margaret Taylor & K. Sydny Fujita, *Accounting for Technological Change in Regulatory Impact Analysis: The Learning Curve Technique*, U.S. DEP'T OF ENERGY (Apr. 30, 2013), https://eta.lbl.gov/sites/default/files/publications/lbnl-6195e_.pdf. For an example of agencies moving backward in their analysis, see Natalie Jacewicz & Richard L Revesz, *The EPA is Rolling Back Protections with Methodology No Respectable Economist Would Endorse*, HILL (Mar. 4, 2019), https://thehill.com/opinion/energy-environment/432471-epa-is-rolling-back-protections-with-methodology-no-respectable.

236. *See* Robert W. Hahn & Robert E. Litan, *Recommendations for Improving Regulatory Accountability and Transparency*, Testimony 03-2: AEI-BROOKINGS JOINT CTR. FOR REG. STUD. 5, 12–13 (2003), https://www.brookings.edu/wp-content/uploads/2016/06/03_accountability_litan.pdf (citing low levels of compliance with regulatory analysis requirements among agencies. "It is clear from a careful review of regulatory impact analyses that agencies are currently not taking the guidelines imposed by the executive branch very seriously in carrying out regulatory analyses."); *see also* GAO, REGULATORY REFORM: AGENCIES COULD IMPROVE DEVELOPMENT, DOCUMENTATION, AND CLARITY OF REGULATORY ECONOMIC ANALYSES, *supra* note 3.

might use interdependencies to justify changing a rule's regulatory analysis to a net cost to repeal it. Similarly, an agency might use interdependencies to manufacture net benefits for a rule. While this paper hopes that agencies will be able to use the ideas of this paper to change their analysis, it is possible that this approach might be abused by agencies or administrations with particular agendas.

Our response to this is that since interdependencies are real, agencies will eventually begin to use them in calculating their regulatory analysis anyway. If agencies are to analyze interdependencies, they should do so in a manner that is disciplined and evidence driven; it is not the use of MCBA that undesirably increases agency discretion, but rather an ad-hoc approach to interdependencies.[237] Therefore, the principles supported in this paper will help limit agency discretion, rather than increase it. Since MCBA procedure asks agencies to make their assumptions explicit and explain how and to what levels interdependencies exist, it will facilitate more accurate estimates and allow enhanced scrutiny of agency action. In turn, this will increase accountability. Additionally, we believe that if agencies can create better quantitative estimates, then they can make rules with less subjectivity.[238] Finally, as a backstop, the courts will be able to ensure that agencies do not abuse their authority by checking their analyses.[239] The use of disciplined MCBA will make such oversight easier.

237. These are discussed in *supra* Part II.C.4.

238. Former OIRA Administrator Cass Sunstein has often talked about how numbers can help take some of the subjectivity and partisanship out of rulemaking. Dylan Matthews, *Can Technocracy be Saved? An Interview with Cass Sunstein*, VOX (Oct. 22, 2018), https://www.vox.com/future-perfect/2018/10/22/18001014/cass-sunstein-cost-benefit-analysis-technocracy-liberalism ("If you could show that a certain approach to, let's say, motor vehicle safety would save 700 lives annually and cost $8,000, it wouldn't matter what your values are, if you're sane. That's a pretty good thing to do.").

239. Despite common commentary that courts are not competent to check agency decision making because they lack expertise, at least one study has shown this to be untrue. Caroline Cecot & W. Kip Viscusi, *Judicial Review of Agency Benefit-Cost Analysis*, 22 GEO. MASON L. REV. 575 (2015) (evaluating judicial review of agency CBA based on a sample of 38 judicial decisions and finding that courts are both willing and competent to evaluate CBA, including its methodology and assumptions).

E. MCBA vs. Regulatory Budgets

Concerns about excessive regulation—driven implicitly by a concern that the *aggregate* costs of regulation on society are not being captured by CBA[240]—have led to the development of Regulatory Budgets, such as the Trump administration's One-In Two-Out program.[241] In that sense, regulatory budgeting is a partial alternative to MCBA, in that it addresses cost interdependencies between large numbers of rules.

MCBA is a superior alternative to regulatory budgets. A regulatory budget is a limit to the cost an agency can place on society. In the sense that a regulatory budget attempts to handle the problem of overregulation, it is a cousin of MCBA. However, MCBA is a more disciplined method of handling regulation levels because it does not make arbitrary decisions about the optimal overall level of regulation, and addresses problems of both over and under-regulation rather than only addressing over-regulation.

A regulatory budget, broadly, is an analog to a federal fiscal budget. It mandates a limit on the cost an agency can set on private parties. The uneasiness about increasing numbers of regulations and regulatory costs has led to the increased popularity of regulatory budgeting techniques. One of them is the now famous (or infamous) One-In Two-Out program (OITO).[242] One part of this program is the limit on the regulatory cost imposed by an agency.[243] The idea of a regulatory budget is not new and has rarely been seen as partisan. In 1979, Democratic Senator Lloyd Bentsen proposed a cap for the compliance cost created by each agency's regulations.[244] The 1980 Economic Report of the President mentioned the idea to Jimmy Carter.[245] In fact, the idea of eliminating rules to pass new rules has been

240. *See supra* Part I.D.

241. *See* Exec. Order No. 13,777.

242. *See id.*

243. *Id.*

244. 125 CONG. REC. S2024 (1979) (statement of Sen. Lloyd Bentsen).

245. COUNCIL OF ECON. ADVISERS, EXEC. OFFICE OF THE PRESIDENT, ECONOMIC REPORT OF THE PRESIDENT (1980), https://fraser.stlouisfed.org/files/docs/publications/ERP/1980/ERP_1980.pdf.

considered by both political parties recently[246] and similar programs have been implemented in numerous developed countries.[247]

However, despite gaining support throughout history, regulatory budgets are an inferior approach to interdependencies than Multiple-Rule CBA. First, current regulatory budget approaches are arbitrary because they depend on current levels of costs or regulation to set limits. This fails to address possible systematic over-regulation in one industry, and under-regulation in another. It also fails to account for the fact that some industries might deal better with over-regulation than others (which would also change how that industry defines over-regulation).[248] Finally, it is highly likely that agencies will not be able to pass net-beneficial regulations because it would violate their cost constraint. MCBA on the other hand asks agencies to construct efficient networks of rules and therefore does not make these arbitrary distinctions.

Second, regulatory budgeting only addresses over-regulation, not under-regulation. Regulatory budgets are concerned with making sure that agencies do not impose too much cost on American society. But, even if agencies can accurately account for

246. Senator Mark Warner (D-VA) advocated for a type of regulatory budgets called 'regulatory pay-go' as part of his election platform. Mark Warner, *To Revive the Economy, Pull Back the Red Tape*, WASH. POST (Dec. 13, 2010), https://www.warner.senate.gov/public/index.cfm/regulatory-paygo.

247. Canada began experimenting with regulatory budgeting and a 'one-in-one-out' rule at the federal level in 2015. Red Tape Reduction Act, SC 2015, c 12. For a deeper discussion of Canada's experimentation with regulatory budgeting, see Sean Speer, *Regulatory Budgeting: Lessons from Canada* (R Street Policy Study No. 54, Mar. 2016), https://www.rstreet.org/wp-content/uploads/2016/03/RSTREET54.pdf. The British government first adopted a 'one-in-one-out' policy in 2005. HM Government, One-in, one-out: Statement of New Regulation (Apr. 2011), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48179/2836-onein-oneout-statement-new-reg.pdf. The UK has since changed to 'one-in-two-out' and then 'one-in-three-out.' *See* Ryan Bourne, *President Trump's "One-in, Two-out" Rule: Lessons from the UK*, CATO INST. (Jan. 31, 2017), https://www.cato.org/blog/president-trumps-one-two-out-rule-lessons-uk.

248. For example, if a company sets up a compliance department on a fixed salary that allows the company to meet more or fewer regulatory requirements by filing the proper paperwork and doing compliance reviews.

the total cost of their rules and regulations, which is much harder than only accounting for significant regulations and may not be possible,[249] what if an industry is actually under-regulated at this point? In that case, we would want more regulation to increase the benefits to American society. This was the case with cryptocurrencies in late 2017 and is the case with many emerging technologies today. For such situations, regulatory budgets fail to provide the flexibility to allow agencies to pass the rules needed to keep America competitive and safely regulate industries.

The support for regulatory budgeting also often relies on faulty argumentation. Regulatory budget supporters often discuss the difficulty of identifying the dollar value of benefits relative to the ease of understanding the costs to private industry. However, costs are not necessarily easier to understand than benefits and estimates of the total cost of regulation differ by trillions of dollars depending on the report.[250] Moreover, costs are constantly changing, and costs of regulation substantially decrease as regulated entities make one-time purchases to comply with regulations.[251] Finally, the difficulty in quantifying benefits means agencies will generally underestimate them. This suggests that agencies would under-regulate, rather than over-regulate, when they use CBA.[252] However, regulatory budgeting

249. Susan E. Dudley, *Can Fiscal Budget Concepts Improve Regulation*, 19 N.Y.U. J. LEGIS. & PUB. POL'Y 259, 268 (2016) (advocating for the usefulness of regulatory budgets while acknowledging difficulties regarding cost estimates) ("The tasks of gathering and analyzing information on the costs of all existing regulations in order to establish a baseline budget would be enormous, and the resulting number not very reliable. Even defining what should be considered 'costs' would be challenging. Estimating the opportunity cost of regulation is not as straightforward as estimating fiscal budget outlays, where past outlays are known and future outlays generally can be predicted with some accuracy.").

250. *Compare* W. Mark Crain & Nicole V. Crain, *The Cost of Federal Regulation to the U.S. Economy, Manufacturing, and Small Business*, NAT'L ASS'N OF MFRS. 1 (Sept. 10, 2014), http://www.nam.org/Data-and-Reports/Cost-of-Federal-Regulations/Federal-Regulation-Full-Study.pdf (showing the $2 trillion cost in 2012), *with* Bentley Coffey et al., *The Cumulative Cost of Regulations* 8 (Mercatus Center *Working Paper*, Apr. 2016), http://mercatus.org/sites/default/files/Coffey-Cumulative-Cost-Regs-v3.pdf (finding that federal regulations cost $4 trillion in 2012).

251. *See, e.g.*, EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, *supra* note 130 at 5-7.

252. *See, e.g.*, Robert H. Frank, *Why is Cost-Benefit Analysis so*

is organized around the assumption that agencies over-regulate by setting a cost cap. An MCBA approach does not suffer from this flaw.

CONCLUSION

The last half-century has seen an incredible growth in the sophistication with which agencies analyze individual rules. They must now ensure they see the forest for the trees. In a complex regulatory environment, rules have effects on the efficacy of other rules. The bigger picture of a regulatory project can thus look vastly different to the results of individual economic analyses. Agencies conducting only the latter commit interdependency error and risk passing bad rules or passing over good ones.

In this Article, we analyze this problem in depth and come to the following conclusions. First, interdependencies are pervasive, significant, and are mostly unaccounted for by current agency CBA procedures. Second, given practical constraints on agency fact-finding, the question of how agencies should incorporate possible interdependency is a difficult problem. Third, nonetheless, agency analyses should account for interdependencies through a multiple-rule approach, and there are effective principles and tools agencies can use to do this. Finally, interconnectedness between rules means that agency findings will be highly dependent on initial assumptions. As a result, it is more important than ever that agencies use the best tools available to understand how regulations are impacting American society. MCBA fills this gap and will be more precise and less arbitrary than current approaches targeted at curbing overregulation, such as regulatory budgets.

Despite the prevalence of interdependent rules, little academic discussion exists, and no widespread methodologies have been formalized to address them. We hope that by discussing the interdependency issue in depth we will begin a

Controversial, 30 J. L. STUD. 913, 928 (2000) ("Opposition to cost-benefit analysis may also stem from the fact that the costs of a policy change are often far easier to quantify than its benefits, especially in the domains of environmental policy and health and safety policy. In both fields, consensus about how to measure benefits has proved especially elusive.").

dialogue on how to better address this issue. We believe that small changes in procedure can address a surprisingly large amount of the unaccounted-for costs of interdependencies and that these changes should happen now. As the regulatory state becomes increasingly entrenched and regulation becomes increasingly complex, agencies need to use the best tools to ensure that they are serving the American people. This means taking steps toward using Multi-Rule CBA. This will continue to ensure that agency rulemaking most effectively supports the American people.

Appendix — Clusters in Interdependency Matrices

	Rule A	Rule B	Rule C	Rule D	Rule E	Rule F
Rule A		High Neg. Interdep.	High Neg. Interdep.			
Rule B	High Neg. Interdep.		High Neg. Interdep.			
Rule C	High Neg. Interdep.	High Neg. Interdep.				
Rule D					High Pos. Interdep.	High Pos. Interdep.
Rule E				High Pos. Interdep.		High Pos. Interdep.
Rule F				High Pos. Interdep.	High Pos. Interdep.	

Figure 1: An example of an interdependency matrix with clusters. Here, there is a negative interdependency cluster, (A, B, C) and a positive interdependency cluster (D, E, F). Having concluded that interdependencies in the other cells are unlikely, an agency can narrow down its MCBA analysis to two groups of 3 rules.