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MULTIPLE-RULE COST-BENEFIT ANALYSIS

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MULTIPLE-RULE COST-BENEFIT ANALYSIS

Vartan Shadarevian^{*} & *Robert Delaney*^{**}

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Federal agencies must conduct regulatory analysis on potential rules in order to make sure that they work for the benefit of the public. When doing this, agencies conduct cost-benefit analysis (CBA) on that rule individually. This ‘piecemeal’ approach essentially evaluates the benefits and costs of a rule while holding the regulatory environment otherwise fixed. But the regulatory environment is not otherwise fixed. Rules can have ‘complementary’ effects, whereby one rule can increase the effectiveness of another rule. They can also have ‘substitute’ effects, 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 rule effects confound the validity of individual CBA estimates that consider rules one-at-a-time. In such situations, current CBA practices lead to improper rule promulgation and review. 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. After exploring the authority behind cost-benefit analysis, this paper then explains the interdependency problem whereby rules interact and thereby change their net-benefits. This paper then provides support for a multiple-rule approach and provides principles and tools that an agency can use when implementing, removing, updating, or replacing a rule.

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 increasing volumes of federal regulation benefit the American people.² For the last three decades, academics have hotly debated the usefulness and consequences of CBA.³ Recently, the debate has shifted to whether

¹ See Exec. Order No. 12,866, 3 C.F.R. 190 (1994) (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 and 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 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

we should require independent agencies (including financial regulators) to use CBA and to what extent CBA impacts agency independence.⁴ Despite decades of discussion on the topic, the debate will likely continue indefinitely. Any rule that fails to pass CBA requires a waiver and, as a result, an agency's approach to CBA may radically change the rules on its books. Similarly, conducting CBA improperly can lead to administrations implementing flawed policies or allow administrations to remove good policy for political gain. This paper seeks to ensure that CBA is conducted the right way by examining one problem in current practice.

Currently, when agencies conduct cost-benefit analysis on rules, they consider each rule individually.⁵ At the simplest level, an agency examines the impact of a rule, conducts a benefit calculation, and subtracts the costs. However, as this paper will go on to show, this method can lead to extreme variations in net benefits that can lead to rules being passed or removed when they should not have been. This is because no rule operates in a vacuum. Many rules interact with each other in what we call 'interdependencies.' As a result, agencies must consider the impact of a rule in conjunction with other rules. This is more important in today's regulatory environment than ever before. The number of regulations and rules has continually risen in the last 40 years.⁶ The EPA, for example, has over 170,000 "regulatory

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 and Matthew D. Adler, *Rethinking Cost-Benefit Analysis* 109 YALE L. J. 165, 167–168 (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.); GENERAL ACCOUNTING OFFICE, GAO/RCED-84-61, COST BENEFIT ANALYSIS CAN BE USEFUL IN ASSESSING ENVIRONMENTAL REGULATIONS DESPITE LIMITATIONS (1984); GENERAL ACCOUNTING OFFICE, GAO/RCED-98-142, REGULATORY REFORM: AGENCIES COULD IMPROVE DEVELOPMENT, DOCUMENTING, AND CLARITY OF REGULATORY ECONOMIC ANALYSIS (1998).

⁴ See, e.g., Grant M. Hayden and Matthew T. Bodie, *The Bizarre Law and Economics of Business Roundtable v. SEC*, 38 J. CORP. L. 101, 102 (2012) (arguing that *Business Roundtable* sets a new standard of review in which courts do not show deference to agency decision making); Jill E. Fisch, *The Long Road Back: Business Roundtable and the Future of SEC Rulemaking*, 36 SEATTLE U. L. REV. 695, 697–98 (2013) (analyzing the impact of *Business Roundtable* on the requirements placed on the SEC); Robert H. Ahdieh, *Reanalyzing Cost-Benefit Analysis: Toward a Framework of Function(s) and Form(s)*, 88 N.Y.U. L. REV. 1983 (2013) (discussing *Business Roundtable*'s dramatic departure from the requirements imposed on independent agencies); Eric Posner, *Controlling Agencies with Cost-Benefit Analysis: A Positive Political Theory Perspective*, 68 U. CHI. L. REV. 1137, 1141 (2014) (proposing that cost-benefit analysis helps congress retain control over agency regulation); Michael A. Livermore, *Cost benefit Analysis and Agency Independence*, 81 U. CHI. L. REV. 609, 609 (2014) (arguing that cost-benefit analysis preserves agency independence by limiting review of agency actions).

⁵ See OFFICE OF MGMT. & BUDGET, CIRCULAR A-4, at 1–2 (2003), available at <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>.

⁶ COLOMBIAN COLLEGE OF ARTS AND SCIENCES, *Reg Stats*, available at <https://regulatorystudies.columbian.gwu.edu/reg-stats> (Showing less than 30 economically

restrictions.”⁷ Despite recent policy developments in the Executive Branch, this number will most likely continue to increase in the coming years.⁸

The foundation for the idea of interdependencies lies in the field of economics’ conception of substitutes and complements.⁹ Rules often have ‘complementary’ effects, whereby one rule increases the net benefits of another rule. They also often display ‘substitute’ effects, whereby one rule decreases the net benefits of another rule. As perhaps the clearest example, alternatives to rules can be conceptualized as rules with strong substitute effects: implementing one rule almost entirely negates the benefits of the second rule.

Interdependencies are pervasive and undermine the accuracy of the net benefit figures that agencies produce under current methods.¹⁰ Interdependencies between rules are both significant and pervasive. Often, multiple regulations affect the same markets, thus impacting the efficacy of other rules. The costs of complying with regulations can compound, or they can make the per-rule cost of compliance cheaper. Similarly, second and third-order effects of rules can significantly increase the costs or benefits of other rules. Interdependencies also exist among groups of related rules, such as regulatory over-burdening whereby the cumulative impact of regulation prevents activity rather than the substance of the regulation itself. Without considering the complex and significant ways that rules interfere with each other, agencies can pass rules that they claim have significant net benefits while, in some cases, less than half of the expected benefits materialize while costs increase on U.S. households.¹¹

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 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 FR 9339 §1 (2017) available at <https://www.govinfo.gov/content/pkg/FR-2017-02-03/pdf/2017-02451.pdf>

(“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.”)

⁹ See, e.g., Walter Nicholson, MICROECONOMIC THEORY, 164–68 (9th ed. 2005).

¹⁰ See Matthew C. Turk, *Overlapping Legal Rules in Financial Regulation* 38 (Kelly School of Business Research Paper Series: Research Paper Number 18-76, September 2018) (“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).”).

¹¹ See Cohen, *infra* note 83.

However, this problem is not fatal to CBA. Agencies can take steps to account for interdependencies. For example, the U.S. Environmental Protection Agency (EPA) has begun to consider the interdependencies between rules. However, their approach has not been formalized and does not fully account for the issues newly identified in this paper.¹² Moreover, agencies are resource-constrained and accounting for every possible set of interdependent rules is non-trivial without an efficient approach.¹³ In addition to discussing this issue in depth for the first time, this paper proposes principles and multiple heuristics that agencies can use to tackle this problem.

Even with the approach of this paper, agencies need to proceed carefully in designing complex models to more accurately carry out CBA. MCBA adds yet another layer of complexity to an already difficult exercise. In complex models, an agency's initial assumptions of the regulatory environment profoundly affect their conclusions. As a result, political judgments, values, and beliefs may drastically impact outcomes. That said, the MCBA approach requires agencies to be more explicit about their assumptions and produces more reliable results than one-size-fits-all alternative solutions, including regulatory budgets and one-in-two-out. Unlike those approaches, the MCBA approach does not assume regulation itself is bad and does not involve arbitrary decisions regarding how much regulation agencies should eliminate.

This paper 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 in order to show that they are pervasive and examines whether agencies consider them to a sufficient extent. Part III introduces and defends MCBA as a stand-alone procedure or supplement to traditional CBA. In this section we discuss the legal support for this approach and responses to criticisms. Part IV discusses the need for a deliberate approach and provides principles and tools that agencies can use in modifying their procedures.

PART I. THE RISE OF COST-BENEFIT ANALYSIS

Cost-benefit analysis is a cornerstone of regulatory process in the United States. At its simplest level, CBA (also called benefit-cost analysis) is a tool to determine a regulation's financial costs and benefits to society. This calculation includes the indirect and direct costs and benefits of the regulation. Decision makers use CBA

¹² See EPA, *Guidelines for Preparing Economic Analysis*, *infra* note 83.

¹³ One can imagine that when an agency only has 1 rule it must only consider 1 rule. If it has 2 rules it must consider each alone and the two together for a total of 3. An agency with 3 rules must consider the three rules individually, the three combinations of 2 rules, and all three together for a total of 7. This increases exponentially so that an agency conducting exhaustive cost benefit analysis on 10 rules would have to consider 1023 situations. 100 rules would require 1.3×10^{30} situations. See *infra* *The need for a Deliberate Approach—the Curse of Dimensionality*.

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. 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 amounts of federal regulation.¹⁴ 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.¹⁵ 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.¹⁶ 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.¹⁷

On February 17, 1981, President Reagan institutionalized cost-benefit analysis through Executive Order 12,291.¹⁸ Executive Order 12,291 aimed to reduce the economic burden of regulation on the economy by increasing the scrutiny that agency regulations must endure.¹⁹ In this initial version of CBA, Reagan required that “regulatory action shall not be undertaken unless the potential benefits to

¹⁴ *Reagan Orders Cost-Benefit Analysis of Regulations, Confers Broad Powers on OMB and Regulatory Task Force*, 11 ENV. L. REPORTER 10044 available at <https://elr.info/sites/default/files/articles/11.10044.htm>.

¹⁵ Exec. Order No. 11,821, 3 C.F.R. 203 (1971-1975) 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) 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).

¹⁶ Exec. Order No. 11,949, *supra* note 15.

¹⁷ Exec. Order No. 12,044, 3 C.F.R. 671 §3(b)(1) (1978) available at <http://www.thecre.com/pdf/12044.PDF>

¹⁸ Exec. Order No 12,291, 3 C.F.R. 127 (1982) available at <https://www.archives.gov/federal-register/codification/executive-order/12291.html>.

¹⁹ *Id.*

society from the regulation outweigh the potential costs to society.”²⁰ The executive order applies to all regulation that causes an impact to the economy greater than \$100 million, major price increases, or significant adverse effects on competition, innovation, employment, productivity, or investment.²¹ 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.²² 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.²³

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.”²⁴ Thus, regulations no longer needed to have quantifiably greater benefits than costs. Also significant to this paper, Executive Order 12,866 requires that agencies “tak[e] into account, among other things, and to the extent practicable, the costs of cumulative regulations.”²⁵ Otherwise, the order generally matched

²⁰ *Id* at §2.

²¹ *Id.*

²² *Id.*

²³ *Id* at §3.

²⁴ Exec. Order No. 12,866, 3 C.F.R. 638 §1(b)(6) (1994).

²⁵ *Id* at §2(b)(11). This was addressed again by OIRA in guidance put out in 2012. *See* OMB, Cumulative Effects of Regulation, *infra* note 70.

Executive Order 12,291's definition for a significant action²⁶ and continued to require an analysis of cost, benefit, and an examination of alternatives.²⁷

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.²⁸ 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.²⁹ Finally, the executive order requires that agencies designate a presidential appointee as a regulatory policy officer who has to approve regulations.³⁰ These changes are still in effect and modified but did not broadly change the mandate set out by President Clinton.³¹

President Obama generally reaffirmed President Clinton's Executive Order 12,866 in Executive Order 13,563. The executive order kept the pillars of identifying benefits and costs, examining alternatives and choosing the one that imposes the least burden while considering the effect of cumulative regulations. Executive Order 13,563 adds the requirement that agencies must "use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible."³² Additionally, it requires that agencies develop plans to periodically review existing significant regulations and to "modify, streamline,

²⁶ *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).

²⁷ *Id.* at §6(c)(1–3).

²⁸ See Exec. Order No. 13,422, 72 Fed. Reg. 2763 (2007) available at <https://www.govinfo.gov/content/pkg/WCPD-2007-01-22/pdf/WCPD-2007-01-22-Pg48.pdf>

²⁹ *Id.*

³⁰ *Id.*

³¹ See Robert W. Hahn and Robert E. Litan, *Evaluating the New Executive Order on Regulation*, AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES, Testimony before the House Investigation Oversight Subcommittee Science and Technology Committee 1 (April 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. STUDIES Q. 531 (September 2007) (arguing that Executive Order 13,422 creates substantial changes that increases the President's power over rulemaking while acknowledging that the impact will depend on implementation).

³² Exec. Order No. 13,563, 3 C.F.R. 215 §1(c) (2012), *reprinted in* 5 U.S.C. §601 app. at 103–104 (2014) available at <https://www.govinfo.gov/content/pkg/CFR-2012-title3-vol1/pdf/CFR-2012-title3-vol1-eo13563.pdf>.

expand, or repeal them” accordingly.³³ This process is called retrospective review.³⁴ 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 possible techniques.’

Most recently President Trump’s Executive Order 13,771 reaffirms the core principles of CBA contained in Clinton’s 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.³⁵ However, it requires that for every new regulation issued, an agency must find two existing rules to be repealed.³⁶ 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.³⁷ While this has significant impact on agency behavior, it ultimately does not change the CBA requirement from under President Obama.

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.³⁸ The executive order requires the task force to make recommendations regarding rules that agency heads should modify, replace, or repeal.³⁹ It also puts in place additional categories of rules that agencies must identify and review in

³³ *Id.* at §6.

³⁴ 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* (December 4, 2014).

³⁵ See Exec. Order No. 13,771, *supra* note 8.

³⁶ *Id.*

³⁷ *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.

³⁸ Exec. Order No. 13,777, 82 Fed. Reg. 12,285 §3(d) (2017) (“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”).

³⁹ *Id.*

order to strengthen regulatory review programs.⁴⁰ This order provides muscle to support the continuing review of existing regulation while explicitly supporting Executive Order 13,771, Executive Order 12,866, and Section 6 of Obama's Executive Order 13,563.

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 1980⁴¹ or others that provide independent agencies rulemaking authority may require them to conduct some type of regulatory analysis.⁴² 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.⁴³

⁴⁰ *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 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).

⁴¹ 5 U.S.C. §§601–6012 (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.

⁴² *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).

⁴³ *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

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.⁴⁴

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 533⁴⁵ in order to determine if a rule continues to be effective or useful. Thereby, agencies use CBA when conducting retroactive review in order to weigh the current costs and benefits of a regulation and determine its effectiveness. We argue that the need to conduct CBA throughout the life-cycle of a rule and not only in its promulgation provides support for the concept of multiple-rule analysis described later in this paper. This section provides an overview of the requirements of retroactive review.

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.⁴⁶ 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.⁴⁷ 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).⁴⁸ Concerned that agencies were not pursuing this effort seriously enough, in March 1995, President Clinton ordered federal agencies to do a page-by-page

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).

⁴⁴ 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)).

⁴⁵ *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29 (1983) [hereinafter *State Farm*] (holding that for the purposes of APA 553, rescission or modification of a previously promulgated regulation is subject to the same judicial scrutiny as the agency's initial adoption of its rules).

⁴⁶ Exec. Order No. 12,044, *supra* note 17.

⁴⁷ Exec. Order No. 12,291, *supra* note 18 at §2

⁴⁸ Exec. Order No. 12,866, *supra* note 24 at §5

review of existing regulations to determine which regulations could be replaced or repealed.⁴⁹ 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.⁵⁰

President Obama continued this legacy, ordering agencies to submit a plan to OIRA regarding how they will review their existing regulations. However, despite the reaffirmed directive, agencies repealed or modified only a small number of rules relative to the number of rules passed each year.⁵¹ 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.⁵² 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 in order to nominate various rules to be evaluated and potentially modified, repealed, or replaced.⁵³ Executive Order 13,771's mandate that agencies identify two rules to repeal when proposing a regulation added significance to this requirement by

⁴⁹ U.S. GENERAL ACCOUNTING OFFICE, REGULATORY REFORM: AGENCIES' EFFORTS TO ELIMINATE AND REVISE RULES YIELD MIXED RESULTS (1997) available at <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.")

⁵⁰ See Curtis W. Copeland, *Federal Regulatory Reform: An Overview*, CRS REPORT FOR CONGRESS 28 (2004) available at https://www.everycrsreport.com/files/20040420_RL32356_0adcbdcf4cf1d9b3cbad37c605d48834afb64fcc.pdf.

⁵¹ See Connor Raso, *Assessing regulatory retrospective review under the Obama administration*, BROOKINGS (June 2017) available at <https://www.brookings.edu/research/assessing-regulatory-retrospective-review-under-the-obama-administration/>.

⁵² *Id.* See also GENERAL ACCOUNTING OFFICE, REEXAMINING REGULATIONS: OPPORTUNITIES EXIST TO IMPROVE EFFECTIVENESS AND TRANSPARENCY OF RETROSPECTIVE REVIEWS 36 (2007) available at <https://www.gao.gov/new.items/d07791.pdf>.

⁵³ See Executive Order 13,777 *supra* note 38.

incentivizing agency heads to utilize their RRTFs. The effects of this program have yet to be seen.⁵⁴

The retrospective review requirement provides support for the concept of multiple-rule CBA. Retrospective review 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-4⁵⁵ 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.⁵⁶ This section focuses on the second and third elements required by Circular A-4. While each agency interprets the guidance of the document for their individual field, 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.⁵⁷ This baseline determination is critical to the analysis because it requires agencies to identify what the world looks like in the next 5, 10 or even 50 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 other regulations"⁵⁸ (emphasis added). Oftentimes an agency may consider multiple baselines in order understand the modeler's uncertainty about the status-quo. The circular cites examples of best practices in this regard.⁵⁹

⁵⁴ Ted Gayer, Robert Litan, and Philip Wallach, *Evaluating the Trump Administration's Regulatory Reform Program*, THE BOOKINGS INSTITUTION (2017) available at https://www.brookings.edu/wp-content/uploads/2017/10/evaluatingtrumpregreform_gayerlitanwallach_102017.pdf.

⁵⁵ See OMB, Circular A-4 *supra* note 5.

⁵⁶ *Id.*

⁵⁷ *Id.* at 15 ("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.").

⁵⁸ *Id.* at 15.

⁵⁹ *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

When analyzing the costs and benefits, agencies are required to consider both the direct and indirect effects of the regulation. 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. 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.⁶⁰ When more uncertainty surrounds these calculations, agencies are required to use increasingly formal and complex models to understand the uncertainty in their calculations.⁶¹ For many regulations in today’s complex, regulatory-rich and information-rich environment, even small impacts can have wide ranging effects. Therefore, agencies should use formal models to 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 multiple tests. 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 run tests with varying assumptions to determine each assumption’s impact.⁶² 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.⁶³

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.”).

⁶⁰ 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 26.

⁶¹ *Id* at 41–42.

⁶² *Id* at 42 (“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.”)

⁶³ *Id* at 38 (“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 thus requires 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 paper 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 Circular A-4.

PART II. THE PROBLEM OF INTERDEPENDENCES

Despite the current practice of understanding regulations’ impacts individually against a baseline, regulations rarely, if ever, operate in a vacuum. In reality, 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 significant benefits for society as a whole.

For example, imagine a situation where Regulation 1 limits Pollutant A and Regulation 2 limits Pollutant B. Assume that either Pollutant A or B is eliminated in such a way that the other is almost entirely limited as well. In effect, either Regulation 1 or 2 may individually prevent the harmful results of both pollutants. However, 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 understanding which regulation is more efficient (assuming that these rules were not considered as alternatives to one another).

This section of the paper 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 that regulations benefit the public. First, we will discuss interdependencies in theory and prove their theoretical existence. Second, we will demonstrate the existence of interdependencies in practice. Third, we will show that the impact that interdependencies have on regulatory analysis is not captured by current practice. Finally, we will consider possible explanations for why agencies have not developed a comprehensive approach to addressing interdependencies.

A. Interdependencies in Theory

Interdependencies exist between regulations in a variety of ways. Regulations may have substitute effects, complementary effects, compound effects, or even macro-interdependencies that influence their costs and their benefits to society. These concepts have been applied only recently to literature on regulation⁶⁴ and their use has been distorted and without quantitative rigor.⁶⁵ This section proceeds to review these concepts 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.

1. Substitute Effects

Simply put, ‘substitute effects’ 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, $R_1 \dots R_N$. Rules R_1 to R_N exhibit substitute effects 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 alone.⁶⁶ In other words, there is at least one subset of the group of rules 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.

⁶⁴ After reviewing the literature, the first paper that seems to address this idea directly is Turk, *Overlapping Legal Rules in Financial Regulation & the Administrative State*, *supra* note 10. 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 fn12.

⁶⁵ We disagree with Turk’s application of complements and substitutes. Since Turk avoids considering costs and quantifying joint net benefits of interdependent regulations, his approach is unusable for agencies. Turk initially properly identifies the damage of substitute effects in regards to their net benefits. *Id* at 3 (“Implementing a rule that provides net benefits when viewed on its own will not improve the regulatory framework if a side effect of doing so is to crowd out reliance on another rule that is a superior substitute.”). However, he then proceeds to advocate for substitutes with unique benefits without consideration of cost or net benefits. *Id* at 12 (“First, unlike perfect substitutes, some degree of overlap is efficient for imperfect substitutes, because each rule provides a unique set of benefits that cannot be crowded out by the other.”). This undermines identification of optimal regulatory combinations and instead supports simplistic, imprecise, relative regulatory levels. *Id* at 27 (“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”). This is not practically useful for agencies.

⁶⁶ That is to say, $CBA(R_1, R_2 \dots R_N) < CBA(R_1) + CBA(R_2) \dots + CBA(R_N)$.

If an agency ignores substitute effects, 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.

2. Complementary Effects

Complementary effects are the opposite of substitute effects. Complementary effects 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 a number of rules, $R_1 \dots R_N$. Rules R_1 to R_N exhibit complementary effects if the benefits and costs of passing all N rules is *higher* than the sums of the benefits and costs of passing each rule alone.⁶⁷ 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 complementary effects, 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. Simply put, when passed together, rules that have complementary effects will have net benefits that are ‘greater than the sum of their parts.’

3. Compound Effects

Compound effects occur when additional rules change the nature of the complementary and substitute effects impacting an existing set of rules. Complementary effects and substitute effects might be particularly easy to analyze when considering only two rules. This analysis become 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 substitute effects. But the three of them together create a strong complementary effect. This would be the case when trying to prevent smuggling into a country 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,

⁶⁷ That is to say, $CBA(R_1, R_2 \dots R_N) > CBA(R_1) + CBA(R_2) \dots + CBA(R_N)$.

smugglers will change tactics to use the remaining routes. A result, if one or two routes are secured, then there will be costs incurred to the government of \$20 million or \$45 million dollars 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.

In an even more complex scenario, there could be a situation in which whether any two rules have substitute or complementary effects 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 substitute effects. However, when Rule C is not part of a baseline for analysis, then no significant substitute effects 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.

There are other theoretical possibilities, but in general an agency should be able to understand these impacts intuitively such as with the smuggling example. The most difficult to analyze situations involve paradigm shifting regulations. However, the most straightforward way to determine new interdependencies would be to reevaluate its existing rules in the new paradigm's context and consider interdependencies among them. For example, agencies can consider the paradigm shifting regulation as part of its baseline and analyze other rules together with regard to it.

4. 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. There are several reasons macro-interdependencies arise and impact the true net benefits of groups of rules.

First, costs might not arise when considering small numbers of rules, but as the number of rules increases, increasing costs require companies to make a significant change that incurs substantial 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.⁶⁸ Second-order effects,

⁶⁸ Business Roundtable, *Business Roundtable's Position on Regulatory Reform* available at <https://www.businessroundtable.org/archive/media/news-releases/business-roundtable-position-on-regulatory-reform> (“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.”).

such as deterring entry into markets, might also only be noticeable when the regulatory atmosphere is significantly more restrictive.⁶⁹ These have been addressed as cumulative effects by OIRA.⁷⁰

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 10 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 accidentally violate regulations. This may especially be the case with small entities. Regulated entities have limited attention and capacity to keep track of and comply with regulations. As rules proliferate, entities will have a more difficult time ensuring compliance, once again failing to achieve the regulation's estimated net benefit.⁷¹

⁶⁹ Essentially this could be described as a chilling effect due to the number of regulations rather than the content of regulations themselves. This 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 LAW REVIEW 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 (February 2017) available at <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 STREET JOURNAL (January 18, 2011) available at <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.").

⁷⁰ Office of Management and Budget, *Cumulative Effects of Regulation*, Memorandum for the Heads of Executive Departments and Agencies, from Cass R. Sunstein, Administrator (March 20, 2012) available at <https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/inforeg/cumulative-effects-guidance.pdf>.

⁷¹ This situation is sometimes called 'regulatory overload.' See, e.g., Andrew Hale, David Borys, and Mark Adams, *Regulatory Overload: A Behavioral Analysis of Regulatory Compliance*, (Mercatus Center Working Paper No. 11-47, November 2011) available at

Concern for macro-interdependencies is an issue to which agencies must pay close attention. It is not only an issue for the legislative to worry about when determining budgets and crafting statutes that authorize regulation. 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.⁷² 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. In precisely this way, large regulatory schemes might be *self-defeating*. As a result, agencies need to think about macro-interdependencies because regulatory sprawl might impair their ability to carry out their mandate.

5. Interdependencies in Agency Analyses

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. As referenced in the end of the previous subsection, interdependencies will lead to flawed analysis depending on the situation in which the agency is performing the cost-benefit analysis. Below we discuss the various ways that interdependencies can impact analyses based on how the agencies are analyzing the rules relative to each other. Interdependencies have different effects depending on whether some of the rules are already enacted or are future potential rules not yet in consideration.

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* Ilya Somin, *Why the rule of law suffers when we have too many laws*, THE WASHINGTON POST (October 2, 2017) available at 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 (“it 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.”); Steven Davis, *Regulatory Complexity and Policy Uncertainty: Headwinds of our own Making* (presented at the Hoover Institution Conference at Stanford University, February 9-10, 2017) available at 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).

⁷² 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 . . .”).

Case 1: The agency 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 carrying out CBA with each rule in respect only to existing rules and not each other. If there are substantial substitute effects, an agency may decide to promulgate each rule even when it should only promulgate one of them. If there are substantial complementary effects, 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, substitute and complementary effects are correctly accounted for.

However, the result of substitute effects 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.

Case 2 will never yield errors when there are only complementary effects. 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: Some of the interdependent rules are neither in place, nor are currently being considered (they are potential rules)

An even more difficult case occurs when agencies recognize in their analysis that complementary or substitute effects may develop in the future with rules not yet considered. This may occur because agencies do not have a particularly good idea of which rules they are expecting to pass in a rapidly changing regulatory environment (consider the internet)

This third case is worth flagging up separately because it adds another layer of difficulty for agencies. Anytime an agency considers a rule, there might be a not-yet-considered rule which displays significant interdependencies. How can an agency account for this?

To some degree, Case 3 can be dealt with by waiting for a Case 2 problem to arise. Once a potential rule actually enters the realm of consideration, agencies can compare it to existing rules or rules currently under consideration and determine if there are interdependencies that alter the analysis. The difficulty of doing so, however, is that 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 complementarities that induce agencies to reconsider previous rules they had dismissed.

Case 4: Interdependencies and sunseting

Changes in the regulatory environment can cause rules to not achieve their calculated benefits or incur additional costs due to sunseting.⁷³ If an agency does not consider the disappearance of rule A with sunseting provisions, it may fail to pass rule B if there are substitute effects between the rules.

Case 5: Timing-dependent interdependencies

In certain cases, the existence or size of interdependencies will depend on the order or timing in which rules are implemented. The implication of this is that the size of the complement or substitute effects might depend on the order in which the rules are considered, or duration for which some rules have already been in place. This both supports the urgency with which agencies need to consider interdependencies and the careful attention they must pay to incurred costs on private entities when changing regulations. Ultimately, the failure to consider interdependencies in advance of rules might have lasting effects.⁷⁴

⁷³ For example, almost all tariffs automatically expire after a certain duration. The International Trade Administration has rules that automatically expire after 5 years and have to be reviewed and re-implemented. When assessing the implementation of new rules and tariffs, the IAT should consider not simply the evolution of the economic and regulatory environment, but it should also predict the future state of its existing sunseting regulations and whether they will be passed again in considering the usefulness of a new rule.

⁷⁴ 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 rule complementarity. 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 2, rendering its investment in 1 obsolete. This also negates the complementarity 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 give multiple examples to show the existence of interdependencies in practice. A common theme is that we see complementary effects when a regulation will bring us closer to efficient market outcomes and substitute effects when regulations move us away from efficient market outcomes. This section begins by looking at interdependencies in environmental regulations. In environmental policy, regulations often have similar goals and one positive change may have many ancillary benefits. As a result, because of the non-linear benefit curve of reducing hazardous emissions and the presence of significant amounts of pollution in the atmosphere, we most often will see substitute effects. However, there are also situations where piecemeal regulations never see their estimated net benefits because some players are allowed to ‘cheat’ and therefore additional regulations would move us toward efficient outcomes and have complementary effects. Second, we look at safety regulations where most safety regulations have substitute effects with each other because, similar to environmental regulations, multiple, sometimes duplicate regulations achieve the same benefits and each additional regulation provides decreasing marginal returns. Third, we look at financial regulations, where overlapping regulation often has substitute effects similar to the previous sections, but in cases of good policy we see complementary effects. Finally, we discuss general market effects of regulation that have interdependencies.

1. Environmental Regulations

Environmental regulations often have interdependencies because multiple regulations attempt to achieve the same goal. Emissions regulations are a classic example of this. For example, multiple EPA regulations target different entities with the goal of reducing greenhouse gas emissions.⁷⁵ Reducing levels of these emissions has significant positive impacts on human and environmental health.⁷⁶

⁷⁵ The EPA has produced a number of regulations under the CAA with identical 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 (September 15, 2011); Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources; Electricity Generating Units; Proposed Rule, 77 Fed. Reg. 22392 (April 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 (October 2012) available at <https://www.brookings.edu/wp-content/uploads/2016/06/26-climate-change-wallach.pdf>.

⁷⁶ See Robert E. Hall, Chun-Wait Lee, Ravi K. Srivastava, and Nick D. Hutson, *Mercury Control Technology – A Review* (International Conference on Combustion, Incineration/Pyrolysis, Emission

In quantifying these benefits, these rules' regulatory impact analyses recognize multiple possible values for the cost of carbon, but each considers these fixed costs per unit based on annualized discount rates.⁷⁷ However, the social cost of carbon is not fixed. The cost of greenhouse gases increases based on the amount of emissions currently in the atmosphere.⁷⁸ In fact, the social cost of carbon is expected to drastically increase in future years as greenhouse gases continue to accumulate in the atmosphere.⁷⁹ As a result, GHG regulations have substitute effects on each other whereby each regulation decreases the net benefits of other regulations by reducing the marginal benefit of reducing greenhouse gases and other hazardous emissions. Similar effects occur in most all contexts where the impacts of a regulation have non-linear costs or benefits.

One mechanism through which these common benefits are achieved are control technologies. 'Control technologies' are technologies required by regulations to accomplish their objectives. These technologies exhibit strong substitute effects with other regulations when an ancillary benefit of the control technology is similar to the other regulation's intended effect and that benefit has decreasing marginal effect. 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.⁸⁰ As a result,

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).

⁷⁷ See, e.g., Environmental Protection Agency, Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards (August 2012) (using \$5, \$22, \$37, and \$68 as the various social costs of carbon). See also Environmental Protection Agency, The Social Cost of Carbon (January 2017) available at https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html (showing single value costs for carbon dioxide, methane, and nitrous oxide)

⁷⁸ Dozens of papers and studies have established that greenhouse gases such as carbon dioxide have non-linear impacts on temperature change. See Ram Ranjan, *Optimal carbon mitigation strategy under non-linear feedback effects and in the presence of permafrost trigger hazard*, Vol. 19. Iss. 4 MITIGATION AND ADAPTION STRATEGIES FOR GLOBAL CHANGE 479 (April 2014) (finding that there is a carbon threshold which poses disproportionately larger risks to the environment). See also Lei Zhu, Xiao-bing Zhang, and Ying Fan, *A Non-Linear Model for Estimating the cost of Achieving Emission Reduction Targets: The Case of the U.S., China, and India*, Vol. 21 No. 3 J. SYS. SCI. SYS. ENG. 297 (September 2012);

⁷⁹ Environmental Protection Agency, The Social Cost of Carbon, *supra* note 77 ("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.").

⁸⁰ See, e.g., Environmental Protection Agency, Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter 4.A-1 (December 2012)

the regulation removed mercury and other harmful chemicals from the air beyond the intended scope of the regulation. While this is a good thing, this may reduce the future net benefits of mercury emission regulation.⁸¹

A similar finding previously occurred involving the control technologies for the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR). In this case, the reduced mercury emissions caused by CAIR's control technology reduced the baseline of mercury in the air and therefore caused the CAMR to have fewer net benefits than it otherwise would have.⁸²

Substitute effects also arise in certain situations where environmental regulations are implemented in series. For example, in order to reduce phosphorous emissions into waterways, 17 states banned the sale of high-phosphorus dishwasher detergent. High levels of phosphorus in waste water 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. As a result, 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.⁸³ This shows how environmental rules implemented in a series may have

available at <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 PM_{2.5}, from non-EGU point and nonpoint sources and acknowledging that such technologies will simultaneously reduce emissions of PM₁₀).

⁸¹ 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.

⁸² See Environmental Protection Agency, *Guidelines for Preparing Economic Analysis* 5-11 (December 17, 2010) (updated May 2014) available at <https://www.epa.gov/sites/production/files/2017-08/documents/ee-0568-50.pdf> ("In 2005, EPA promulgated both the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR) to reduce pollution from coal fired power plants. While the primary purpose of CAIR was to reduce sulfur dioxide (SO₂) and nitrogen oxides (NO_x), the control technologies necessary to achieve this also reduced mercury emissions. Because the CAMR analysis assumed that CAIR had been implemented and was, therefore, in the baseline, the estimated incremental reduction in mercury from CAMR was much smaller than if CAIR had not been included in the baseline.").

⁸³ Alex Cohen & David Keiser, *The Effectiveness of Overlapping Pollution Regulation: Evidence from the Ban on Phosphate in Dishwater Detergent* 3 (Selected Paper prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, July 31-August 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.")

substitute effects 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 had substantial benefits that outweigh its costs.⁸⁴ However, these benefits would nearly triple if it was supplemented with additional regulation that prevents SO₂ levels from increasing to the CAIR cap.⁸⁵ The authors argue that while cap-and-trade will reduce the number of coal fire power plants, as plants shut down, existing plants may save costs by reducing the amount of SO₂ removed from their emissions, negating the impact of fewer coal plants.⁸⁶ As a result, the majority of the estimated benefits of the regulation will not materialize. While this emphasizes the importance of preventing regulated entities from cheating, it also illustrates complementary effects (assuming that the additional costs are not prohibitively high to eliminate the increased benefits) and the importance of considering multiple regulations in order to achieve maximum net benefits.

2. Safety Regulations

Another area where interdependence develops is in safety regulation. Safety regulations often have substitute effects with additional, related safety regulation. For example, decreasing the speed limit across the country to 10 miles per hour would create costs from increased travel time and benefits from less frequent and severe traffic accidents. However, this regulation would also almost entirely remove the benefits from airbag requirements and other safety measures while leaving their costs unchanged. Another example of this is safety regulation in construction sites. As certain dangerous breathable substances are banned from worksites, costs of construction will go up and worker-related health benefits will increase. Meanwhile, the benefits of worker protective gear including the use of

⁸⁴ Britt Groosman, Nicholas Z. Muller, and Erin O'Neill-Toy, *The ancillary benefits from climate policy in the United States*, Vol. 50 No. 4 ENV. AND RESOURCE ECON. 585–603 (2011).

⁸⁵ *Id.* See also Britt Groosman, Nicholas Z. Muller, and Erin O'Neill, *The Ancillary Benefits from Climate Policy in the United States* 1 (Draft White Paper, November 2009) (“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.”).

⁸⁶ *Id.* at 5 (“Relative to the policy scenario with default assumptions, when SO₂ emissions from 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.”).

protective masks or respirators decreases because there are fewer harmful chemicals to be protected from.⁸⁷

Rules that are considered alternatives during the rulemaking process and those safety regulations that are classified as redundant in practice are classic examples of substitutes that share benefits. For example, in *Motor Vehicle Manufacturers Association v. State Farm Mutual*,⁸⁸ the court declared that the National Highway Traffic Safety Administration (NHTSA) needed to consider non-detachable belts as a possible alternative to rescission of the rule on detachable belts. The court required this consideration because the rules operate in such a way as to capture almost all of the other's benefits while imposing similar costs. The court held that considering these alternatives were important to consider because one could replace the other. By this same reasoning, these two rules are examples of substitutes since implementing both rules (and essentially requiring two seatbelts) would only slightly improve safety while doubling costs.

3. Financial Regulations

Interdependencies are common in financial regulation as well. A compelling example of two financial rules that had substitute effects on each other are the original dual structure securities laws. The SEC recognized the duplicate regulation and integrated the dual disclosure regime into a single set of rules.⁸⁹ Substitute effects 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. Substitute effects are present here because if, for example, the bank leverage ratio was raised to 50%, then its own net benefits would (most likely) decrease and the benefits of other bank safeguards would decrease as well.⁹⁰ Finally, living wills and total loss absorbing capital (TLAC) levels exhibit substitute effects because increased levels of total loss absorbing capital reduce the

⁸⁷ Of course, this will only truly be a substitute 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(164) Federal Register (August 24, 2006); Final Rule 29 CFR 1910, 1915, and 1926 available at <https://www.osha.gov/laws-regs/federalregister/2006-08-24> (discussing the benefits of respirators as a product of the harmful chemicals that workers avoid breathing in).

⁸⁸ *State Farm*, 463 U.S. 29 (1983).

⁸⁹ 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 law were consolidated into Regulation S-K).

⁹⁰ Example modified from Turk, *Overlapping Legal Rules in Financial Regulation*, *supra* note 10 at 25.

need for living wills by making a ready source of capital available. Substitute effects are therefore seen between living wills and capital adequacy requirements.⁹¹

Additionally, financial regulations demonstrate complementary effects when implementing rules together creates more market efficient outcomes. A complementary interdependence exists when creating corresponding levels of bank supervision and deposit insurance. For example, assume that new 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 complementary effect between deposit insurance and bank supervision.⁹²

4. Market Effects of Regulations Generally

As a general category, market effects may be the most pervasive and difficult to capture type of interdependency that occur in everyday life. Effects on markets, and particularly prices, might link the impacts of rules that are otherwise not interdependent. For example, as regulations on steel mill pollution increases, the cost of combustion car engines may increase, decreasing consumption for gas-powered automobiles. This, in turn, may decrease the marginal benefit of auto pollution regulation as additional consumers change to electric vehicles (if for example those net benefits were derived from cost being minimized through economies of scale). 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 exit despite the fact that no single substantive regulation requires firms to leave the market. This can alter consumer prices and product availability in a way that has net costs for society.

C. Current Attempts to Address Interdependencies

Agencies have used various approaches that partially address the interdependency problem. However, after examining these approaches, none of

⁹¹ 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 36.

⁹² This is taken from but significantly different than the example in Turk, *Overlapping Legal Rules in Financial Regulation*, *supra* note 10 at 12. Turk identifies a complementary effect 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 fn53.

them effectively allow agencies to conduct CBA in the face of interdependencies. This section first looks at combining rules. Then it considers timing issues in conjunction with sensitivity analysis. Finally, it considers multiple baseline approaches.

1. 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.⁹³ The main problem with combining linked rules is that the current approach does not lay out methods for choosing sets. 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 in one or multiple analyses have negative CBA results but in conjunction with other 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 rule being considered. In this way, agencies may continue to see inefficient path dependencies even when using this procedure to pass optimal new rule sets.

2. Multiple Baselines

As discussed in Circular A-4 and the EPA guide, Agencies are expected to incorporate multiple baselines in their analysis when the rule's impacts with various baselines is uncertain.⁹⁴ In theory, a rich enough multiple baseline approach is

⁹³ See EPA, Guidelines for Preparing Economic Analyses, *supra* note 82 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.").

⁹⁴ *Id* ("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.").

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 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.⁹⁵ 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

It's also important to point out that using the multiple baseline approach obscures analysis. First, it may hide baseline rules' interactions since they are not the focus of the study. Second, this approach reduces the learning value of agencies' analysis and therefore prevents agencies from improving their approaches and understanding over time. In this way, agencies fail to learn about their policies and develop better rulemaking in the future.⁹⁶

⁹⁵ For example, for 10 rules this implies each rule can be calculated with respect to $2^9 = 512$ baselines. This means that, for 10 rules, the total number of different CBA analyses is $10 * 512 = 5120$ baselines.

⁹⁶ Administrative Conference of the United States, *Recommendation number: 2017-6: Learning from Regulatory Experience* (December 15, 2017) available at <https://www.acus.gov/recommendation/learning-regulatory-experience> (“[agencies] can learn from

3. 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.⁹⁷ 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. This implicitly recognizes interdependencies by acknowledging that including different rules in baseline estimates will impact the results.

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.

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

The EPA's Guidelines for Preparing Economics Analysis is the only agency guideline we are aware of that recognizes interdependencies.⁹⁸ However, even in this case there is no approach that avoids the pitfalls previously described. This section attempts to offer some explanations why this may be the case. We present three reasons why this may be the case: 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.

1. CBA is New and Developing

Executive Order 12,866 first ordered agencies to conduct CBA in 1983. Agencies have spent the last 36 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.⁹⁹ Agencies initially developed manageable solutions. As a result, much agency work over the years has been dedicated to solving basic aspects

experience at one or more stages of the rulemaking process, from pre-rule analysis to retrospective review. Before adopting a rule, agencies can learn from pilot projects, demonstrations, and flexibility among states or regulated entities.”).

⁹⁷ See, e.g., EPA, *Guidelines for Preparing Economic Analysis*, supra note 82 at 5–12.

⁹⁸ *Id.*

⁹⁹ See, e.g., *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837 (1984).

of CBA such as quantifying cost and benefits (a task that is still far from complete) and working on data collection.¹⁰⁰ This problem is compounded by the variation in how agencies carry out CBA.¹⁰¹ Overall, the evolution of single rule CBA has taken priority over considering more complex approaches.

In addition, some agencies have not developed complex CBA procedures because not all agencies frequently use CBA. In some cases, this is because courts have ruled that the statutory language authorizing regulation by an agency does not permit the consideration of costs.¹⁰² In other cases, it is that regulations do not have greater than \$100 million of impact on the economy and are therefore not significant.¹⁰³ As a result, some agencies do not have significant experience with conducting CBA.

2. 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.¹⁰⁴ 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.¹⁰⁵

3. 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.¹⁰⁶ However, we have only found one agency that is

¹⁰⁰ For examples of recent developments in CBA, see David Pearce et. al, *COST-BENEFIT ANALYSIS AND THE ENVIRONMENT: RECENT DEVELOPMENTS* (2006).

¹⁰¹ See, e.g., David W. Perkins and Maeve P. Carey, *Cost-Benefit Analysis and Financial Regulator Rulemaking*, CONGRESSIONAL RESEARCH SERVICE 9 (April 12, 2017) available at <https://fas.org/sgp/crs/misc/R44813.pdf>.

¹⁰² See, e.g., *Whitman v. Am. Trucking Associations*, 531 U.S. 457 (2001).

¹⁰³ See Executive Order 12,866, *supra* note 24.

¹⁰⁴ For the development of CBA, see generally, Thomas O. McGarity, *REINVENTING RATIONALITY THE ROLE OF REGULATORY ANALYSIS IN THE FEDERAL BUREAUCRACY* (1992).

¹⁰⁵ See Raso, *Assessing regulatory retrospective review under the Obama administration*, *supra* note 51.

¹⁰⁶ President Clinton's executive order recognizes cumulative effects as well as regulatory conflict. Executive Order 12,866, *supra* note 24 ("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").

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.¹⁰⁷ However, even despite this mandate, the EPA has not created a comprehensive approach to interdependencies. Most agency's 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 similar to the errors that will 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.¹⁰⁸ Similarly, in 2017 the White House recommended continued use of multiple baseline analysis when doing analysis for regulations under Executive Order 12,866.¹⁰⁹ However, while the multiple baseline approach is a good starting point and is currently being implemented at least by the EPA, it does not sufficiently deal with the issue of interdependencies.¹¹⁰

¹⁰⁷ EPA, *Guidelines for Preparing Economic Analysis*, supra note 82 (“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.”).

¹⁰⁸ OMB, Circular A-4, supra note 555 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 multiple scenarios, with and without these rules in the baseline, may be necessary”).

¹⁰⁹ See Guidance Implementing Executive Order 13,771, Titled “Reducing Regulation and Controlling Regulatory Costs,” Memorandum for Regulatory Policy Officers at Executive Departments and Agencies and Managing and Executive Directors of Certain Agencies and Commissions, From Dominic J. Mancini, Acting Administrator, Office of Information and Regulatory Affairs (April 5, 2017) (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.”).

¹¹⁰ See *infra* Multiple Baselines.

Ultimately, 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 difficult currently.¹¹¹ However, when significant regulatory action costs the United States billions of dollars each year, hope and advocacy is not enough. As President Obama ordered, “agencies must use the best tools available”¹¹² in order to ensure that they are not wasting millions of taxpayers’ dollars. For this reason, we need a coherent approach to this problem.

PART III. IN SUPPORT OF MULTIPLE-RULE COST-BENEFIT ANALYSIS

Despite the pervasive and complex issue of interdependencies, agencies can take steps to effectively address these issues. We propose that agencies adopt multiple-rule cost-benefit analysis (MCBA). Multiple-rule cost-benefit analysis is simply an approach that considers the costs and benefits of groups of interdependent regulations in order to find frameworks, sets of interdependent rules, with maximum net benefits. While we do not propose any specific comprehensive 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. In this section, we will describe the legal support for this type of approach compared to existing approaches. 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. Legal Support for MCBA-based Approaches

MCBA is not only effective, it is also in-line with the legal mandate placed on agencies. The current legal requirements placed upon agencies support the proposition that agencies must consider significant interdependencies in their CBA. In this section, we consider in greater detail to which there is legal justification for the use of an MCBA framework in agency analysis.

¹¹¹ The difficulty and complexity in single rule CBA has led critics to compare agency rulemaking proposals to advocacy statements rather than true analysis. Jerry Ellig, *Why and How Independent Agencies Should Conduct Regulatory Impact Analysis*, Vol. 28 No. 1 CORNELL J. L. & PUB. POL’Y. 1 (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.”).

¹¹² Executive Order 13,563, *supra* note 32.

1. Circular A-4's requirement to consider multiple baselines and assumptions

Circular A-4's requirement to use multiple baselines fully supports this paper's proposal for MCBA. The circular requires that agencies use multiple baselines when varying baselines could lead to significant changes in CBA. This multiple baseline mandate acknowledges the future's uncertainty and that changes in assumptions including shifting economic, political, or other forces will have various impacts on new and potential rules' costs and benefits. Rules are an inevitable part of this global economic landscape and considering how rules interact is necessary to get accurate estimates. As a result, when agencies anticipate significant interaction between rules, they must consider the various impact of rules' interaction in order to get the most accurate results, fulfill their mandate, and explore the impact of various assumptions.

2. Circular A-4's requirement to consider second order effects

Circular A-4 requires that agencies consider second and third-order effects. Considering second and third order costs and benefits is necessary to properly perform cost benefit analysis. Second and third-order effects often include price changes, redistributive impacts, behavioral adjustments, and health effects. Dozens if not hundreds of regulations cover these areas and their primary and secondary effects can undermine each other's costs and benefits. In order to properly account for second-order effects (and primary effects for that matter) agencies need to consider the overlapping impacts of their regulations in order to properly quantify them.

3. The requirement to conduct retrospective review

Presidents Obama and Trump have both charged agencies with conducting retrospective review in order to modify, repeal, or replace existing regulations. The goal of retrospective review is to eliminate rules that are no longer effective or improperly implemented in the first place. Part of doing this is understanding both how and why rules are no longer effective. If a good rule is no longer creating net benefits because an inefficient rule is limiting its effectiveness, then agencies should consider take steps to understand this before eliminating the rule outright. MCBA allows agencies to undertake this type of an analysis during retrospective review in order to optimize the regulatory environment.

Doing this multiple rule analysis is the best way to carry out the retrospective review task. Rather than conducting CBA on individual existing rules and eliminating them based on that basis alone, agencies that consider the regulatory environment through a multiple-rule approach will have significant efficiency gains. This will have learning effects, prevent agency selection bias from eliminating effective rules, and reduce the amount of time that an ineffective regulation remains in force. By better carrying out their regulatory mandate,

agencies will be able to ensure that existing regulations better serve the American people.

4. The mandate to use best practices

Obama's Executive Order 13,563 requires that agencies use the best methods available. This is a standard that changes over time. As new tools for analysis become broadly available to the government and commercially, and as data becomes more accessible than ever, the government has a responsibility to leverage new approaches and methodologies to reduce the burden of government regulation. Improvements in data analytics, the advent of big data, improved approaches to data science, and computer automation and machine learning demand that the government use more complex analysis to analyze the impact of its regulations. MCBA approaches represent an improvement over traditional CBA. If this is true, the executive order requires them to use it. Moreover, technological advancements significantly reduce MCBA's burden on agencies, further supporting its implementation.

5. Public Policy

Cost-benefit analysis is designed to help regulations work for all Americans. We believe that agencies have a public policy obligation to use the best approaches possible to analyze regulations. If MCBA helps agencies implement significant rules with higher net benefits for the American people, this is enough to show why agencies should adopt it.

B. 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. However, the flaws that exist in conducting MCBA are not fatal.

1. CBA is an imprecise tool and there are few returns to fine tuning it

CBA has been widely criticized for struggling to properly account for and quantify costs and benefits. As a result, adding additional procedures to make estimates more 'accurate' may not only fail to 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.¹¹³

¹¹³ See, e.g., Cass R. Sunstein, *Is Cost-Benefit Analysis for Everyone?*, 53 ADMIN. L. REV. 299, 303 (2001).

We believe that CBA's entrenchment in the regulatory state is not necessarily a bad thing. While CBA does have shortfalls, it is one of the best tools that agencies have in order to self-discipline rulemaking. More complex CBA procedures will only cause the government to devote more resources and attention to doing CBA. However, this is only a bad outcome if there are better places for agencies to devote resources to. While these changes may increase decision-makers' reliance on CBA estimates, the changes that we suggest, while paradigm shifting, may not be procedurally more complex than minor adjustments that agencies regularly make.¹¹⁴

Second, we believe that today, agencies use CBA in order to be precise, and not only to check major errors in judgement.¹¹⁵ While some agencies may only rely on CBA for develop broad judgement checks with very difficult to quantify costs and benefits, most agencies look to develop precise numbers. This 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. Interdependencies are systematic errors because they will lead to systematic over- or under-regulation across the board.¹¹⁶ Therefore, accounting for interdependencies will eliminate a systematic error and will discipline thinking much in the same way that CBA itself aims to discipline

¹¹⁴ 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. Department of Health and Human Services, Guidelines for Regulatory Analysis (2016). Similarly, the EPA-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 and K. Sydney Fujita, *Accounting for Technological Change in Regulatory Impact Analysis: The Learning Curve Technique*, U.S. DEPARTMENT OF ENERGY (April 30, 2013) available at <https://eta.lbl.gov/sites/default/files/publications/lbnl-6195e.pdf>. For an example of agencies moving backward in their analysis, *see* Natalie Jacewicz and Richard L Revesz, *The EPA is rolling back protections with methodology no respectable economist would endorse*, THE HILL (March 4, 2019).

¹¹⁵ There are many examples of this. Consider the use of multiple means of measuring mortality risk, *see* EPA, *Guidelines for Preparing Economic Analysis*, *supra* note 82 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.

¹¹⁶ 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 size differences across agencies and systemic trends across government.

thinking. As a result, MCBA is an approach that helps solve problems at multiple levels. It may be the case that previously CBA was used as a sanity check,¹¹⁷ but it provides more benefits today as technology and methodology has evolved.

2. Additional Costs of Further Analysis

Another objection to the adoption of multiple-rule procedures is that it adds to the already significant procedural costs of enacting regulation. Some authors have pointed out that CBA is already too resource intensive and not a high enough priority to be done correctly.¹¹⁸ At least one congressional research report on CBA writes that “requirements to perform such [cost-benefit] analyses may restrict agencies from effectively regulating.”¹¹⁹ Even strong proponents of CBA have regularly taken issue with the difficulties involved in doing traditional analysis.¹²⁰ These costs may be prohibitive in conducting good analysis and have the potential to contribute to the ossification of administrative law.

While these are important criticisms, this paper advocates that agencies can account for interdependencies with low-cost methods. This idea is at the foundation of both the principles and the tools that this paper proposes below. Some of the procedures proffered in this paper are meta-analysis and do not require a full understanding of the respective rules. Others are simple heuristics that can be used to select rules for existing procedures. Moreover, the benefits of accounting for interdependencies justify at least some increase in procedural burden. The impact of interdependencies is large enough that moderate levels of additional procedure

¹¹⁷ 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”).

¹¹⁸ See Raso, *Assessing regulatory retrospective review under the Obama administration*, *supra* note 51. 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).

¹¹⁹ David W. Perkins and Maeve P. Carey, *Cost-Benefit Analysis and Financial Regulator Rulemaking*, CONGRESSIONAL RESEARCH SERVICE 3 (April 12, 2017) available at <https://fas.org/sgp/crs/misc/R44813.pdf>.

¹²⁰ Professor 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 STANFORD L. R. 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 Public Law 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 Law and Economics Working Paper No. 150, 2002) (discussing the difficulties that exist in cost-benefit analysis).

have net benefits. Finally, agencies will learn over time when to obtain additional CBA estimates. Therefore, it will become possible for agencies to identify those instances where the additional procedures are required and reduce the marginal cost of analysis.¹²¹

Another criticism of this proposal is that it will add more burden to agency procedure and further ossify administrative law¹²² (if one accepts the premise that administrative law has ossified or that it is a bad thing).¹²³ However, recognizing interdependencies alone will not lead to increased ossification. Additionally, the procedures proposed in this paper are internal agency approaches that can be conducted in parallel with other procedures to avoid time delays. Finally, there are many sources of ossification beyond CBA. Academic literature has pointed to judicial, congressional, and administrative reasons for ossification.¹²⁴ The notice and comment process is often cited as the most difficult burden to overcome.¹²⁵ 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.

Finally, it is worth pointing out that if a procedure is too burdensome an agency is likely simply not to follow it.¹²⁶ As a result, the worst-case outcome is that

¹²¹ For example, it would not take long to produce an interdependency matrix for considered rules.

¹²² “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).

¹²³ Ossification may help agencies pass and retain good laws. See Aaron L. Nielson, *Optimal Ossification*, Vol. 88 No. 5 GEO. WASH. L. REV. (September 2018) available at 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 (Cato Institute, Winter 2018-2019) (discussing how pro-regulation individuals are relying on ossification to preserve important regulations against the pressure to deregulate). See also Jason Webb Yackee and 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*, Vol. 80 No. 5 GEO. WASH. L. REV. 1493 (July 2012) (arguing that the Yackee and Yackee paper fails to undermine or contradict the ossification hypothesis).

¹²⁴ For an in-depth discussion of the history and various explanations of ossification, see Yackee and Yackee, *Testing the Ossification Thesis: An Empirical Examination of Federal Regulatory Volume and Speed, 1950-1990*, *supra* note 123 at 1423–1435.

¹²⁵ See McGarity, *Some Thoughts on “Deossifying” the Rulemaking Process*, *supra* note 122 at 1427–1428.

¹²⁶ See Robert W. Hahn and Robert E. Litan, *Recommendations for Improving Regulatory Accountability and Transparency* 5, 12–13 (testimony before the House Government Reform Committee, March 2003) available at 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 do not change their approach. However, it is still important that agencies recognize interdependencies even if they do not implement a procedure.

3. Increased Agency Discretion

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 alternatively be called its values or politics—can have a significant impact on whether the agency ultimately decides a particular regulation is a good idea. It is possible that agencies could use interdependencies to justify incorrectly passing regulation. For example, an agency might use interdependencies to justify changing a rule's regulatory analysis to a net cost in order 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. As a result, the key is not whether or not interdependencies should be used in regulatory analysis but how they should be used. 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 would create more accurate estimates and allow enhanced scrutiny of agency action. In turn, this will increase accountability. Additionally, we generally believe that if agencies can create better quantitative estimates, then they can make rules with less subjectivity.¹²⁷ Finally, as a backstop, the courts will be able to ensure that agencies do not abuse their authority by checking their analyses.¹²⁸

AGENCIES COULD IMPROVE DEVELOPMENT, DOCUMENTATION, AND CLARITY OF REGULATORY ECONOMIC ANALYSES, *supra* note 3.

¹²⁷ Former OIRA Administrator, Professor 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 (October 22, 2018) available at <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.”).

¹²⁸ 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).

C. MCBA vs. Regulatory Budgets

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 since it is less arbitrary and addresses problems of 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 as a whole on private parties. The uneasiness about increasing numbers of regulations and regulatory cost 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).¹²⁹ One part of this program is the limit on the regulatory cost imposed by an agency.¹³⁰ 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.¹³¹ The 1980 Economic Report of the President mentioned the idea to Jimmy Carter.¹³² In fact, the idea of eliminating rules to pass new rules has been considered by both political parties recently¹³³ and similar programs have been implemented in numerous developed countries.¹³⁴

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

¹²⁹ Executive Order 13,777, *supra* note 38.

¹³⁰ *Id.*

¹³¹ 125 Cong. Rec. S2024 (1979) (statement of Sen. Lloyd Bentsen).

¹³² Economic Report of the President, January 1980 (Washington: Government Printing Office, 1980) available at https://fraser.stlouisfed.org/files/docs/publications/ERP/1980/ERP_1980.pdf.

¹³³ 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*, WASHINGTON POST (December 13, 2010) available at <https://www.warner.senate.gov/public/index.cfm/regulatory-paygo>.

¹³⁴ 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, March 2016) available at <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* (April 2011) available at 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 INSTITUTE (January 31, 2017) available at <https://www.cato.org/blog/president-trumps-one-two-out-rule-lessons-uk>.

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).¹³⁵ 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 the total cost of their rules and regulations, which is much harder than only accounting for significant regulations and may not be possible,¹³⁶ what if an industry is actually under-regulated at this point? In that case we would want more regulation in order 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.

Finally, regulatory budgeting is logically inconsistent. Regulatory budget supporters often discuss the difficulty of identifying the dollar value of benefits relative to the ease of understanding cost on private industry. However, costs are not necessarily easier to understand than benefits and estimates on the total cost of regulation differ by trillions of dollar depending on the report.¹³⁷ Moreover, costs are constantly changing and costs of regulation substantially decrease as regulated

¹³⁵ 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.

¹³⁶ 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.").

¹³⁷ Compare W. Mark Crain and Nicole V. Crain, *The Cost of Federal Regulation to the U.S. Economy, Manufacturing, and Small Business*, NATIONAL ASSOCIATION OF MANUFACTURERS 1 (September 10, 2014) available at <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, Patrick A. McLaughlin, and Pietro Peretto, *The Cumulative Cost of Regulations* 8 (Mercatus Center Working Paper, April 2016) available at <http://mercatus.org/sites/default/files/Coffey-Cumulative-Cost-Regs-v3.pdf> (finding that federal regulations cost \$4 trillion in 2012).

entities make one-time purchases to comply with regulations.¹³⁸ Finally, the difficulty in quantifying benefits means agencies will generally underestimate them. This suggests that agencies under-regulate, rather than over-regulate, when they use CBA.¹³⁹ However, regulatory budgeting is organized around the assumption that agencies over-regulate by setting a cost cap. An MCBA approach does not suffer from this flaw.

PART IV. PRINCIPLES AND TOOLS FOR MULTIPLE-RULE COST-BENEFIT ANALYSIS

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 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 then lay out broad principles to follow when designing these procedures. Finally, we propose tools that can assist agencies in conducting MCBA.

A. The need for a Deliberate Approach—the Curse of Dimensionality¹⁴⁰

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 could identify maximum net benefits if they conduct CBA on every possible combination of rules. 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 a substitute or complementary effect. 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

¹³⁸ See, e.g., EPA, *Guidelines for Preparing Economic Analysis*, supra note 82 at 5-7.

¹³⁹ See, e.g., Robert H. Frank, *Why is Cost-Benefit Analysis so Controversial*, 30 J. L. STUDIES 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.").

¹⁴⁰ "The Curse of Dimensionality" was coined by Richard Bellman in 1957. Richard E. Bellman, *DYNAMIC PROGRAMMING*, Oxford University Press (1957). The Oxford dictionary 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 (4 ed), Eds. John Black, Nigar Hashimzade, and Gareth Myles (Oxford University Press, 2012).

and the number of analyses needed to be conducted is $2^N - 1$.¹⁴¹ 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 10 rules that have interdependent effects.

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. There are a significant number of these frameworks, the possible sets of combinations of interdependent rules. 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.

Without a deliberate approach, testing such a large number of frameworks could easily consume an agency's entire budget. To address this problem, we have developed a set of heuristics based on algorithm development in other fields facing the same difficulty.¹⁴² Before examining tools that agencies can use to address interdependencies, we first discuss principles that any MCBA procedure should incorporate.

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 paper will proffer an approach we call Multiple-rule Cost Benefit Analysis (MCBA). The number of possible MCBA frameworks (subsets on which to conduct CBA) is staggeringly large, and any offered framework will most likely involve some

¹⁴¹ 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".

¹⁴² Methods to counter the curse of dimensionality have developed frequently in fields that rely on complex algorithm creation. See, e.g., Andrew Curtis and Anthony Lomax, *Prior information, sampling distributions and the curse of dimensionality*, Vol. 66 No. 2 GEOPHYSICS 372 (March-April 2001) (discussing methods of circumventing the curse of dimensionality in sampling distributions in Bayesian inversions); Wei Kang and Lucas C. Wilcox, *Mitigating the curse of dimensionality: sparse grid characteristics method for optimal feedback control and HJB equations*, Vol. 68 No. 2 COMP. OPTIMIZATION APPLIC. 289, 290 (April 2017) (discussing the curse of dimensionality in computational optimization); Viktor Minschel and Markus Kratzig, *Solving, Estimating, and Selecting Nonlinear Dynamic Models Without the Curse of Dimensionality*, Vol. 78 No. 2 ECONOMETRICA 803 (March 2010) (discussing the methods to escape the curse of dimensionality econometrics); Francis Bach, *Breaking the Curse of Dimensionality with Convex Neural Networks*, 18 Journal of Machine Learning Research 1 (2017) (recognizing and attempting to circumvent the curse of dimensionality in neural network analysis).

arbitrary decision over other frameworks. Therefore, before discussing a new approach 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 the costs of carrying out cost-benefit analysis is very cheap relative to the number of rules being considered. 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 agencies' prior beliefs will inform the choice of initial cost-benefit analyses and inform how the results of these initial analyses are used. 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.

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. The probability after updating is referred to as the posterior probability. To make such reasoned decisions, an agency should assign prior probabilities to certain outcomes, such as the existence of interdependencies. This approach can happen informally. However, explicitly stating why some options are being considered would help agencies develop more consistent approaches and learn in the rulemaking process.

Principle III: Agencies should design deliberate approaches to MCBA

Agencies need to take a disciplined approach in regard to 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 substitute or complementary effects. 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:

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 taking into account complementarities), 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. Since 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: Retrospective Review matters

Executive Orders and other policies already require retrospective review.¹⁴³ The goal of retrospective review is for an agency to affirm or reject prior CBA estimates. This is an opportune way to understand whether existing rules have

¹⁴³ Since President Clinton, every President has called for retrospective review of existing regulations in order 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, *supra* note 24 (under President Clinton); Executive Order 13,563 (under President Obama), *supra* note 32 at §6; Exec. Order No. 13,610, 3 C.F.R. 13,610 (2012) (under President Obama); Executive Order 13,771, *supra* note 8 (under President Trump).

interdependencies with each other and whether they will have interdependencies with considered rules. Agencies can also use retrospective review to identify macro-interdependencies. Most individual rules do not alone create significant macro-interdependencies. As a result, agencies may have a hard time identifying macro-interdependencies in advance. Agencies can more easily identify them by examining clusters or groups of rules retrospectively. If an agency's retrospective CBA estimate for a 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.

Principle V: Any approach should be adaptable

Agencies should adjust their approach based on their resources, the regulatory context, and 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 Information and Regulatory Affairs to issue memos about “best practices” for CBA analysis.¹⁴⁴ 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.¹⁴⁵

Principle VI: Approaches should use abbreviated analysis when appropriate

¹⁴⁴ See, e.g., Guidance Implementing Executive Order 13771, Reducing Regulation and Controlling Regulatory Costs, *supra* note 109; Office of Information and Regulatory Affairs, Agency Checklist: Regulatory Impact Analysis (October 28, 2010) available at https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/regpol/RIA_Checklist.pdf; Executive Order 13,565, Improving Regulation and Regulatory Review, Memorandum for the heads of executive departments and agencies and of independent regulatory agencies from Cass R. Sunstein, Administrator (February 2, 2011); Office of Information and Regulatory Affairs, Regulatory Impact Analysis: Frequently Asked Questions (FAQs) (February 7, 2011) available at https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf; Office of Information and Regulatory Affairs, Regulatory Impact Analysis: A Primer (August 15, 2011) available at https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf; Treasury and OMB Implementation of Executive Order 12291, Memorandum of Agreement between the Department of the Treasury and the Office of Information and Regulatory Affairs (April 29, 1983) available at https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/memos/2016/omb_moa_83_93.pdf.

¹⁴⁵ 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.

Agencies will have to use abbreviated analysis based on previous CBA results to streamline their process. 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 used to construct additional estimates or additional estimates may be unnecessary.

First, initial CBA analyses 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 and 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.¹⁴⁶ 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 the optimal procedure to conduct CBA while accounting for interdependencies. This approach, which we call MCBA, is a general procedure that agencies should use to understand the interdependencies between rules and select optimal rule sets to analyze. 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-approximation of an MCBA approach that can be 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.

¹⁴⁶ 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.

1. Tool 1 - Interdependency Matrices¹⁴⁷

In order to understand pairwise interdependencies – interdependencies between pairs of rules – before conducting rigorous analysis an agency should produce a matrix that identifies prior expectations about complementarities and substitute effects between rules. In the 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 Substitute	High Complementarity
Rule B			Low Substitute
Rule C			

In order to predict interdependences and fill in the matrix, Agencies 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.¹⁴⁸ 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

¹⁴⁷ 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).

¹⁴⁸ The EPA recognizes that regulations targeting particulate matter have the additional benefit of reducing the emissions of hazardous pollutants. *See* U.S. Environmental Protection Agency Office of Air and Radiation, *Regulatory Impact Analysis for the Final Clean Air Interstate Rule* EPA-451 1-9 (March 2005) (identifying significant unquantified benefits in CAIR including increased crop yields, improved visibility, and health and welfare benefits associate with reduced mercury emissions).

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 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.¹⁴⁹

2. Tool 2 – Cross-Agency Common Effects Lists

In order to discipline agency decision-making, agencies can record and track those benefits and costs that are most likely to be shared 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 cross-organizational 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 Emission	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

3. 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.

¹⁴⁹ 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. U.S. Environmental Protection Agency Office of Air and Radiation, Regulatory Impact Analysis of the Final Clean Air Mercury Rule EPA-452 (March 2005) at 3–24.

After each round, the rules with CBA estimate above some threshold feature in all future rule combinations. Similarly, rules with a CBA estimate below a 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 below figure. 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,¹⁵⁰ 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 to test its complimentary or substitute effects. 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.

	Pre-Estimation	Round 1:	Post Initial Estimation	Round 2:	Post Final Estimation
Most likely to be passed	Rule A	Carry out CBA on Rule A	Rule A	Rule A+B, CBA on Rule A+C	Rule A
	Rule B		Rule B		Rule C
Least likely to be passed	Rule C		Rule C		Rule B

4. 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 lead to 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

¹⁵⁰ How this threshold is determined is not discussed in this paper. The threshold should generally be decided by an exercise of agency judgment.

develop simulations of the world based on its initial beliefs about how rules under consideration interact with each other.¹⁵¹ These simulations will estimate the net benefit of every combination of rules under consideration. Agencies can then test their various iterative approaches with each simulation's 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.

CONCLUSION

This paper examines a previously underdiscussed problem with cost-benefit analysis in a complex regulatory environment: the effects of rules on each other. The conclusions of this paper are as follows. 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. Nonetheless, and third, 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 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, no widespread methodologies have been formalized to address them. We hope that by discussing the interdependency issue in depth we will begin a discussion of 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 to using Multi-Rule CBA. This will continue to ensure that agency rulemaking most effectively supports the American people.

¹⁵¹ 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 82 at 7-5. For an explanation of Monte-Carlo, please see Christian Robert and George Casella, MONTE CARLO STATISTICAL METHODS (Springer-Verlag New York, 2009). Christian Robert and George Casella, MONTE CARLO STATISTICAL METHODS (Springer-Verlag New York, 2009).

Appendix – Clusters in Interdependency Matrices

	Rule A	Rule B	Rule C	Rule D	Rule E	Rule F
Rule A		High Substitut e Effect	High Substitut e Effect			
Rule B	High Substitut e Effect		High Substitut e Effect			
Rule C	High Substitut e Effect	High Substitut e Effect				
Rule D					High Compleme nt Effect	High Compleme nt Effect
Rule E				High Compleme nt Effect		High Compleme nt Effect
Rule F				High Compleme nt Effect	High Compleme nt Effect	

Figure 1: An example of an interdependency matrix with clusters. Here, there is a substitute cluster, (A, B, C) and a complements 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.