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DYNAMIC SCORING:
A PROGRESS REPORT ON WHY, WHEN, AND HOW

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ABSTRACT

By design, official budget estimates for legislative proposals generally exclude the proposals' likely effects on labor, capital, productivity, and output, as well as any feedback from such effects to the federal budget. Policymakers would benefit from knowing the expected sizes of those effects, and advances in research and in the estimating agencies' tools and experience have made such analysis more feasible. If Congress requested that those effects be included more often in official budget estimates—so-called dynamic scoring of legislation—the advantages and disadvantages would vary across policy areas. For some areas, the estimated budgetary impact of the currently excluded effects would be significantly different from the impact of the included effects. But dynamic scoring would be substantially more time-consuming than conventional scoring, and in some areas, the research base is insufficient for credible estimation.

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Economists who study the growth of productivity and output often emphasize the role of public policies that affect labor supply, savings, and federal investments in infrastructure and research. Yet, the official budget estimates provided to Congress when changes in policies are being considered generally exclude—by design—their effects on labor, capital, productivity, and output, as well as any feedback from such effects to the federal budget.

The exclusion of those economic impacts is a longstanding convention of budget estimates produced by the Congressional Budget Office (CBO) and the staff of the Joint Committee on Taxation (JCT). Over time, CBO and JCT have demonstrated a growing capacity to analyze such economic impacts and their feedback to the budget, and the agencies have published more analyses of this sort. But those analyses have been limited in number and generally provided separately from the official estimates on which congressional and public attention is focused during policy debates. The official budget estimates for proposed legislation continue to be produced almost entirely through conventional scoring that excludes those economic impacts rather than so-called dynamic scoring that includes them.

This paper analyzes the economic and institutional issues presented by the choice between conventional and dynamic scoring, as well as by some intermediate approaches. Thoughtful observers of the congressional budget process have a range of views about the best approach, and the agencies appropriately defer to Congress on this choice.

The current estimating convention has been supported by various lines of reasoning. One is that producing dynamic estimates takes too much time and work to be feasible given the large number of proposals for which estimates are needed and the short timeframes typically available for preparing estimates. We take the practical constraints faced by the estimating agencies very seriously. However, CBO and JCT have invested—to their credit—in the tools and experience needed for dynamic analysis, and those investments have reduced to some extent the additional time and work needed to generate estimates. Further targeted investments could make more progress along these lines, but producing dynamic estimates would nonetheless be more time-consuming than producing conventional estimates in most cases.

Another line of reasoning is that the effects of policy changes on outcomes such as labor and productivity may be inherently more uncertain than other effects—and, perhaps relatedly, estimates of those effects might be more subject to external pressure. But in our assessment, uncertainty about the excluded effects is not necessarily greater than uncertainty about effects

that are included, in part because, for some important effects, CBO and JCT can draw on substantial bodies of evidence and receive professional feedback on their use of the evidence. Moreover, including these additional effects would reduce the risk of bias in estimates.

A further line of reasoning in support of the current estimating convention is that the excluded effects are small for most proposals. The impact of most proposals on the aggregate economy is indeed small. However, that information itself can be useful for policymakers, and even a small effect on the aggregate economy can still be meaningful for a proposal's budget estimate. We document an especially stark example of the latter point: For a potential change in the authorized number of high-skilled immigrants, the budgetary impact of the change in population that is excluded from conventional estimates is much larger than the budgetary impact of the included factors and has the opposite sign.

Yet another line of reasoning is that CBO's and JCT's credibility might be damaged by changing their estimating methodology, and especially by reduced transparency due to the complexity of including additional effects. Maintaining the agencies' credibility is indeed crucial for the policymaking process. But in our assessment, the challenges of change and complexity related to dynamic scoring are similar to those with conventional scoring, for which the agencies have made many methodological advances involving greater complexity. In addition, excluding from budget estimates behavioral responses that people expect to occur also can hurt the agencies' credibility.

We want to underscore that official budget estimates from CBO and JCT are not the be-all and end-all of policymaking, even though estimates are sometimes blamed for blocking or inducing certain outcomes. The agencies provide considerable other information through additional material included with official estimates, published reports on policy issues, and informal exchanges with Congress. Other government agencies, analysts outside government, and other private actors also communicate with policymakers and the public. Still, official budget estimates are often consequential in the legislative process, so the conventions underlying those estimates warrant ongoing attention.

We note also that the exclusion of certain economic impacts is not the only aspect of the estimating process that deserves scrutiny and consideration of alternatives. Other effects of proposed policies are sometimes excluded from estimates because of so-called scorekeeping guidelines that have been developed by CBO, the Office of Management and Budget (OMB),

and the House and Senate Budget Committees to help align the estimating process with legislative structures and procedures (CBO 2021a). For example, Hall (2024) explained why estimates of proposed activities to reduce fraud often exclude the impact on program spending or tax collections, and he proposed changes to the scorekeeping guidelines to address the issue.

In the following sections of the paper, we elaborate on the advantages and disadvantages of dynamic scoring, describe potential processes and criteria for Congress to make decisions on the subject, and explain how dynamic scoring might be undertaken. Because discussions of dynamic scoring often focus on tax policies, and because we have greater familiarity with the procedures used by CBO, we focus on spending policies and CBO's methodology, but we include substantial references to JCT's work as well. Many of these issues apply also to OMB, the Treasury Department's Office of Tax Analysis, and unofficial budget estimators outside government. We then present three case studies that illustrate some of the issues raised in the first parts of the paper. These case studies cover immigration policy, federal investment in research and development (R&D), and federal permitting of investment in infrastructure.

I. Why?

We begin with the crucial question of "why" or "why not" to do dynamic scoring; the subsequent sections turn to the following questions of "if so, when" and "if so, how."

I.A. Budget Estimates

CBO and JCT provide to Congress the official estimates of the effects of legislative proposals on the federal budget. CBO produces public estimates for bills after they have been approved by congressional committees; the process of producing those cost estimates is often described as "scoring." For bills that would alter the tax code, CBO's cost estimates use changes in estimated revenues provided by JCT, which publishes its revenue estimates directly as well. In this paper we use the term "budget estimates" to emphasize that changes in both spending and revenues are relevant. In addition, the agencies give private estimates to members of Congress and their staffs for proposals that are being developed and have not been released publicly. In a typical year, CBO publishes roughly seven hundred public estimates, and it and JCT provide thousands of private estimates. For more information on this process, see CBO (2023c) and JCT (2023). Budget estimates are used by Congress to evaluate alternative proposals, to iterate on

policy development, and to enforce budget plans. CBO has been providing cost estimates since its founding roughly half a century ago, and JCT has been in place for nearly a century.

In addition, CBO provides projections of budgetary and economic outcomes under current law that are known as "baseline projections"; budget estimates show effects relative to those baseline projections. And CBO and JCT publish analyses of actual or potential legislative proposals beyond budget estimates; we say more about those analyses shortly.

Both baseline projections and budget estimates typically focus on nominal cash flows for the current fiscal year and each of the ten subsequent years, a period that is often called the "budget window." Baseline projections are extended in less-detailed form beyond the budget window, and budget estimates are sometimes extended as well when Congress is especially interested in long-term effects and when the agencies expect that a proposal's long-term effects would be notably different from its effects over the coming decade.

The budget estimates and baseline projections depend on assessments made by analysts at CBO and JCT and on procedures that have been codified in law or agreed to formally or informally by the relevant congressional committees. The agencies provide objective, nonpartisan analysis at a high professional standard. As a result, their estimates are important not only to Congress but also to press coverage of policy deliberations and to the broader public.

I.B. Behavioral Responses

CBO's and JCT's official budget estimates generally include the impact of behavioral responses to the proposed changes in law. For example, estimates for changes in benefit programs include shifts in take-up rates, and estimates for changes in income tax rates include shifts in the use of tax deductions. The agencies try to account for the behavior of households, businesses, implementers of legislation in the executive branch, and state and local governments; they do not attempt to predict future changes in federal law.

However, CBO and JCT do not include in official budget estimates any behavioral responses that would change the overall economy, which include effects on labor supply, saving and investment, productivity, and aggregate demand. As CBO (2023c) explained: "According to

long-standing practice, CBO's conventional cost estimates reflect the expectation that nominal gross domestic product [GDP] … would not change."[1]

At the same time, CBO and JCT produce some analyses beyond budget estimates that do include effects on labor, capital, productivity, and demand. For example, for some bills, JCT publishes what it terms "macroeconomic analyses," which generally appear several weeks after the official estimates for the bills and which include the budgetary feedback from expected changes in broad economic measures. As another example, in 2013, CBO released a cost estimate prepared by the agencies for a comprehensive immigration bill being debated in the Senate (CBO 2013a) and simultaneously released a report with "estimates of the overall economic impact of the legislation and of the incremental federal budgetary effects of changes in the economy that the cost estimate does not reflect" (CBO 2013b, page 1). And as a further example, CBO publishes reports that analyze the economic and budgetary effects of some potential legislative proposals.[2] We return to each of these examples later.

In this paper we use the term "dynamic analysis" for reports that address broad economic changes outside of official budget estimates and the term "dynamic scoring" for official budget estimates that include those economic changes. The distinction is important because official budget estimates are often the focus of congressional and public attention during policy debates.

For economists, the deliberate exclusion of some behavioral responses from official budget estimates can seem quite odd. A change in a benefit program might induce an individual to stop or start taking up those benefits *and* to change their work effort; from an economic perspective, there is no fundamental difference between those responses, and they may well be directly related. Similarly, a change in the tax code might induce an individual to adjust their tax deductions *and* their saving behavior, and there is no fundamental economic difference between those responses.

Both the behavioral responses that are currently included in official estimates *and* the behavioral responses that are currently excluded can affect the budgetary impact of policy changes. Therefore, including in official estimates all of the foreseeable behavioral responses

[1] JCT's cost estimates reflect the expectation that nominal gross national product (GNP), rather than nominal GDP, would not change. This difference and other complications that arise in applying the general principle are not crucial for our analysis.

[2] In addition, when legislative proposals are enacted, CBO's subsequent baseline projections incorporate those proposals' economic effects and the budgetary feedback from those effects.

would seem to improve the accuracy of the estimates. For any given policy change, some of the behavioral responses may be seen by some policymakers as central or collateral advantages of the policy change and may be seen by other policymakers as disadvantages of the change. But regardless of the desirability or undesirability of certain behavioral responses, including them in budget estimates could help to make the estimates better—with caveats that we turn to shortly.

Moreover, including in official estimates all of the foreseeable behavioral responses gives policymakers information about proposed policies that may be independently relevant to their decisions. For example, policymakers may want to know how a potential change in a benefit program would affect take-up for its own sake—for example, how a change in subsidies for health insurance would affect insurance coverage—in addition to the impact of take-up on the budget. And policymakers may want to know how a policy change would affect labor, capital, and productivity, as well as the follow-on effects on output, inflation, interest rates, and other economic outcomes.

Why, then, are some people who have produced and used budget estimates skeptical about dynamic scoring? Four concerns have been most central to this long-running debate—the feasibility of dynamic scoring, the uncertainty of dynamic estimates, the magnitude of excluded effects, and the credibility of estimates. We take up these concerns in turn.

I.C. Feasibility of Producing Dynamic Budget Estimates Given Time and Resource Constraints

Including additional behavioral responses in budget estimates unavoidably requires more calculations and review, and doing that work would be especially challenging because of the large number of proposals to be analyzed, the many iterations through which proposals are developed, and the short timeframes for producing estimates that Congress allows. These practical constraints are real, and they should be central to discussions about dynamic scoring.

One approach to this feasibility challenge would be to do dynamic scoring only for major legislation. A decade ago, one of us (Elmendorf) wrote: "All of the estimates of macroeconomic effects described above involved significant conceptual and practical challenges and required a great deal of analysts' time to complete. The agencies can devote that much time to only a very small share of the thousands of proposals they examine each year. … For example, when CBO [2015a] examined three ways of reducing spending for the Supplemental Nutrition Assistance Program (commonly known as 'food stamps'), the agency found that even the sign of some

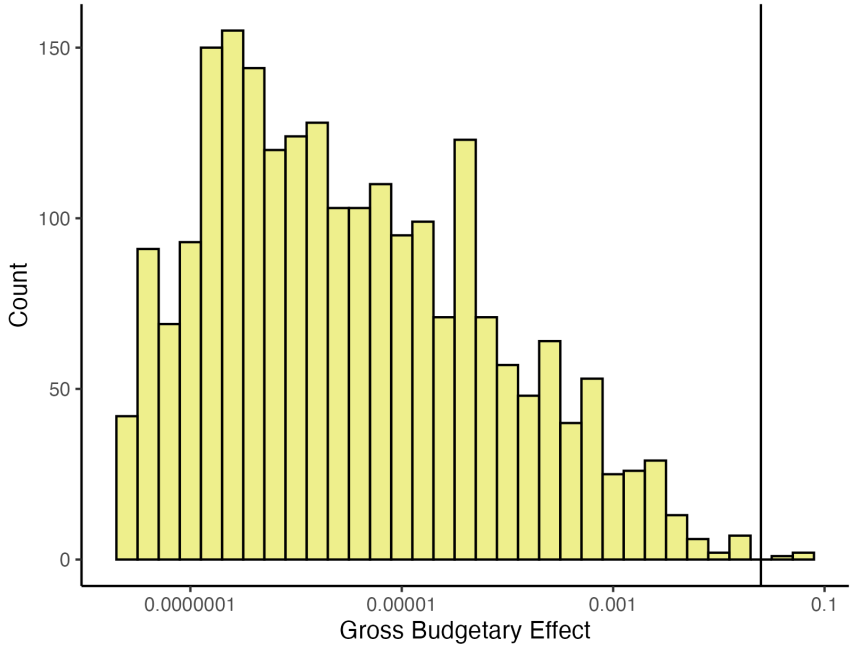
policies' net effect on labor supply was unclear without detailed analysis" (Elmendorf 2015, pages 110-111). He argued therefore that dynamic scoring should be applied only to proposals for which conventionally estimated changes in revenues, spending, or deficits exceed 0.25 percent of projected output over the ten-year budget window (about $900 billion currently).

Indeed, the House of Representatives currently requires CBO and JCT to provide dynamic estimates, "to the extent practicable," for all bills that exceed the 0.25 percent threshold in any year of the budget window (which ranges from about $70 billion to about $100 billion currently) or are deemed "major" by one of a small number of congressional leaders (Lynch and Gravelle 2023). Some version of the House rule has been in effect for much of the past decade. Yet, the threshold is high enough that dynamic scoring has occurred very rarely. Among the roughly 2,700 of CBO's published budget estimates between 2019 and January 2024 for which we could readily code budgetary effects, very few had effects large enough to warrant a dynamic estimate, shown on the far right of figure 1. JCT has published roughly a dozen dynamic analyses over the past decade, which is still a very limited number.

An alternative, possibly complementary, approach to the feasibility challenge would be to standardize or simplify some estimation processes in order to reduce the time and effort needed to produce dynamic estimates. It is said at CBO that estimates are produced by analysts rather than models, because analysts build models, translate legislative language into model inputs, and review model outputs to ensure that the modeling is suitable for the proposals at hand. Thus, standardizing and simplifying estimation processes while maintaining the quality of estimates would not be easy. However, CBO and JCT have invested in the tools of dynamic analysis and gained experience in doing such analysis, which helps in this regard.

Examples of the agencies' dynamic analysis include reports from JCT on the economic effects of four major pieces of tax legislation, which we return to shortly (JCT 2015b, 2015c, 2017, and 2018b), and reports from CBO on repealing the Affordable Care Act, increasing federal investment, responding to the pandemic, funding more federal infrastructure, and raising the minimum wage (CBO 2015b, 2016, 2020, 2021c, 2023e). In addition, CBO has introduced more dynamic complexities into its baseline projections, including a painstaking collation of data on recent immigration and careful modeling of the likely economic and budgetary effects over the coming decade (CBO 2024d).

Figure 1. Gross budgetary effects and the major legislation rule



Source: CBO.
Notes: This figure plots the distribution of estimated gross budgetary effects for the universe of CBO's cost estimates as drawn from the XML files of estimates from the 116th, 117th, and 118th Congresses through January 2024; see https://www.cbo.gov/cost-estimates/xml. The x-axis shows gross budgetary effects relative to GDP and uses a log scale for readability. CBO generally computes gross budgetary effects by summing the absolute value of the budgetary effects of provisions and their interactions (Edelberg 2016); a "provision" corresponds to a line in a table summarizing a CBO estimate. The gross budgetary effects shown here ignore some rare complications that are difficult to calculate from publicly available data. The vertical line denotes the threshold for the House rule in the 118th Congress.

The agencies' new and refined tools and greater experience have made future dynamic estimates somewhat more tractable because the models and learning can be used repeatedly, just as the models and learning underlying conventional estimates are used repeatedly. And as the agencies have applied their technical frameworks to more policy issues, they have refined some of their analytic approaches to be more standardized, analogous to the way that conventional estimating can become standardized with practice. For example, CBO's (2016, 2021c) reports cover similar ground related to the economic effects of federal infrastructure investment, but the later report presents an explicit practical framework that can be deployed in future analyses. Further development of that framework could give analysts standardized algorithms for capturing effects that are now excluded from budget estimates. Similarly, CBO has encapsulated

its expertise in estimating the budgetary impact of economic changes into a budgetary feedback model (Frentz and others 2020), which has been further boiled down to an online workbook (CBO 2023b) and back-of-the-envelope formulas (CBO 2024a).

But even when standardized and simplified approaches have been created, analysts still need to assess whether they are applicable to the proposal at hand or require adjustment. Thus, producing dynamic estimates will continue to be more time-consuming than producing conventional estimates in most cases, and shifting to dynamic scoring broadly would require Congress to accept longer cycle times in those cases.

I.D. Uncertainty of Dynamic Budget Estimates

Budget estimates are unavoidably uncertain. CBO and JCT derive expected behavioral responses to policy proposals using a broad array of evidence, including external economic research, analyses done in-house, and institutional knowledge and anecdotal information from government agencies and others. CBO also has standing panels of outside advisers and has outside experts review some work products. However, many proposals would change policies in ways that have not happened before or have happened only under different circumstances, have not been examined closely in the research literature, or rely on data that have not previously been collected.[3] Therefore, analysts at CBO and JCT often need to produce estimates with limited evidence. Meanwhile, the procedural rules of Congress rely on point estimates rather than ranges, so the agencies focus on point estimates.

If behavioral responses to policy changes are sufficiently uncertain, including those shifts in estimates could reduce the estimates' accuracy. To illustrate this concern, consider a simple example in which an outcome of potential interest has equal probabilities of taking the values -1, 0, 1, or 2. If the outcome is excluded from the estimating process by rule, the estimator is effectively predicting zero all the time, and the root mean square error (RMSE) of the estimates is 1.2, as shown in the first block of table 1.[4] If the estimator correctly predicts the average outcome but has no ability to distinguish between cases where the outcome will be low or high, the estimator predicts 0.5 all the time, and the RMSE dips to 1.1 (as in the second block). If the

[3] As just one example, consider the uncertainty in estimating the budgetary impact of a proposal to make eligibility for subsidized school lunches depend on personal information that is not currently being collected.

[4] In evaluating its estimates, CBO is attentive to both their "centeredness" and "spread" (Hall 2015), and sometimes the agency measures accuracy through the RMSE, which combines bias and variance (CBO 2023d).

estimator incorrectly predicts the average outcome to be zero but correctly orders the outcomes and limits the variability of the estimates, the estimator might predict (in order of the outcomes above) -1, -0.5, 0.5, and 1, and the RMSE falls to 0.6 (as in the third block); if the estimator also correctly predicts the sign of the average outcome, the RMSE falls further. But if the estimator incorrectly predicts the average outcome, correctly orders the different outcomes, and generates estimates that are more variable than the outcomes, the estimator might predict (in the order above) -3, -1, 2, and 4, and the RMSE rises to 1.6.

Table 1. Errors from different illustrative estimation processes

Estimation process	Outcome				RMSE
	-1	0	1	2	
Excluding the variable by rule					
Estimate	0	0	0	0	
Error of estimate	1	0	-1	-2	1.2
Predicting average outcome but not variation					
Estimate	0.5	0.5	0.5	0.5	
Error of estimate	1.5	0.5	-0.5	-1.5	1.1
Not predicting average outcome but ordering correctly and limiting variance of estimates					
Estimate	-1	-0.5	0.5	1	
Error of estimate	0	-0.5	-0.5	-1	0.6
Predicting average outcome and order but having a high variance of estimates					
Estimate	-3	-1	2	4	
Error of estimate	-2	-1	1	2	1.6

Source: Authors' calculations.
Notes: The root mean square error (RMSE) for the estimation process of excluding the variable is calculated as the square root of 0.25*{[0-(-1)]^2+[0-0]^2+[1-0]^2+[2-0]^2}; the other RMSEs are calculated similarly.

These different possibilities show, in the words of CBO, that including additional responses will probably improve the accuracy of estimates "if the estimates are for policies that are likely to have significant feedback effects; if the estimates of those feedback effects are centered around the actual effects; and if the spread of those estimates is small" (Hall 2015, paragraph 12). That is, including additional effects will probably improve accuracy if their mean is different from zero, if the estimator knows the sign of the mean, and if the variance of the estimates is held down.

How do these considerations apply to dynamic scoring? For many potential policy changes, budgetary impacts of factors excluded from conventional estimates are significant relative to the budgetary impacts of included factors and have signs that are widely understood: Examples include changes in income tax rates, shifts in immigration rules that change the population, fiscal stimulus during recessions, and changes in federal investment. Indeed, economists have paid more attention to some responses that are excluded from conventional estimates than many responses that are included, so CBO and JCT can draw on larger bodies of evidence and receive more professional feedback.

At the same time, relevant parameter values cannot be extracted in a simple manner from the research literature on many topics: Estimates of parameters can vary widely, deciding which estimates to weight more heavily can be difficult, and some observers use motivated reasoning in interpreting evidence and could try to pressure the agencies to adopt their interpretation. In addition, the time dimension of dynamic analysis raises further issues. Many estimates in the research literature are for behavioral responses at a point in time and may fit well into cross-sectional models such as microsimulation models, whereas dynamic analysis requires time paths for responses in dynamic models, and linking those approaches is complicated. Moreover, uncertainty in modeling economic effects over time goes beyond specific parameters to the choice of model itself; reflecting that uncertainty, for example, JCT deploys three models in its macroeconomic analyses and varies the weights it attaches to the models depending on the nature of the legislation being analyzed (JCT 2018a).

However, it is important to recognize that these challenges arise also with the behavioral responses included in conventional estimates, such as the effects of increasing the minimum wage on employment and earnings or the effects of changes in health policy on insurance take-

up.[5] CBO and JCT have responded to those challenges by evaluating evidence, reporting their evaluation, soliciting professional feedback, and defending their modeling choices to critics. The agencies have done the same for some behavioral responses included in dynamic analysis, and Congress and the public would benefit from the agencies continuing to do so in the future.

For example, a dozen years ago CBO undertook a comprehensive review of the response of labor supply to changes in fiscal policy. In three linked papers (CBO 2012c; McClelland and Mok 2012; Reichling and Whalen 2012b), the agency documented the estimated elasticities in economic studies and explained the elasticities it chose to use in its analyses (including lower, central, and higher estimates of substitution and income elasticities for primary and secondary earners at different wage levels). Similarly, CBO reviewed research on the response of output to fiscal stimulus under different economic conditions and explained how it applies that research (Reichling and Whalen 2012a; Whalen and Reichling 2015; Seliski and others 2020; Demirel and Wilson 2023), and CBO recently drew on a growing body of evidence on immigration as it modeled the effects of the recent immigration surge (CBO 2024d).

Note also that CBO's evaluation of the evidence did not point to substitution or income elasticities of labor supply that equal zero (although they might be offsetting for some policy changes) nor fiscal policy multipliers that equal zero. Excluding behavioral responses that are not zero greatly increases the chance that the resulting estimates will not be in the middle of the distribution of possible outcomes, which is a natural target for estimators.

Finally, evidence regarding the economic effects of changes in various public policies has expanded considerably over time and continues to do so. For the illustrative examples we discuss later in the paper, we highlight important new research from recent years.

I.E. Magnitude of Policy Effects on Labor, Capital, Productivity, and Other Economic Measures

For almost all policy proposals, their effects on labor supply, saving and investment, productivity, and other economic measures such as output, inflation, and interest rates would be very small relative to the economy's overall amounts or typical levels. However, other considerations related to magnitude are important.

[5] For example, how CBO and JCT might formally take on board the forecasting literature's lesson that accuracy can be improved by "shrinking" estimates is a question that applies to conventional as well as dynamic scoring. See CBO (2019, pages 30 to 35) for one application of CBO's approach to analyzing uncertainty.

First, even if expected changes in those measures are very small in macroeconomic terms, their budgetary effects could be large relative to other budgetary effects of a proposal and thus could significantly affect a budget estimate. For this reason, we do not refer to the excluded effects as "macroeconomic"; they are excluded because of the assumption that proposals do not affect the macroeconomy, but the rationale for including them is not to improve macroeconomic forecasts but instead to more accurately capture the budgetary impact of proposals.

For example, as we explain later, expanding immigration would increase both benefit payments and tax revenue. Conventional estimates include the former but not the latter, leading to estimated increases in deficits; dynamic estimates include the additional revenue as well and show estimated decreases in deficits. Note that this stark difference between conventional and dynamic estimates is unrelated to the number of people affected by a proposal and thus unrelated to a proposal's macroeconomic impact.

Second, a finding that expected changes in labor, capital, productivity, output, and other economic measures are small—in macroeconomic terms or relative to some other benchmark—can be important information for policymakers. Advocates for policies tend to expect large effects on desirable outcomes and small effects on undesirable ones, while opponents tend to expect the opposite. Objective analysis by CBO and JCT can help policymakers and observers sort out the competing claims.

For example, changes in the tax code have effects on labor supply, saving, and investment that are often asserted to be large by some observers and small by others, and that disagreement in turn generates disagreement about the budgetary impact of tax changes. Objective estimates of those effects, even recognizing the uncertainty, are valuable. In this vein, a comparison of JCT's conventional and dynamic estimates for four significant tax bills—as in table 2—shows that the macroeconomic effects were expected to offset between 5 percent and 26 percent of the conventionally estimated revenue loss.[6] Both the larger and smaller offsets provide important information.

[6] Table A-1 of a Congressional Research Service report (Lynch and Gravelle 2023) lists five significant bills for which macroeconomic analyses were released by the estimating agencies (the agencies have published macroeconomic analyses for other bills that we do not address here). Of those five bills, we exclude from the table the Restoring Americans' Healthcare Freedom Reconciliation Act of 2015 because that bill had substantial spending changes that offset some of the tax changes, so comparing the deficit changes with and without the dynamic aspects is not useful for our purpose. In that bill, the dynamic effects make the estimated reduction in tax revenue 27 percent smaller.

Table 2. Comparing conventional and dynamic estimates for tax legislation

Legislative proposal	Budget window	Increase in deficit		
		Conventional estimate (billions)	Dynamic estimate (billions)	Difference (percent)
Tax Relief Extension Act of 2015 (S. 1946)	2016-2025	$97	$87	10
A Bill to Amend the Internal Revenue Code of 1986 to Modify and Make Permanent Bonus Depreciation from 2015 (H.R. 2510)	2016-2025	$281	$267	5
Act to Provide for Reconciliation Pursuant to Titles II and V of the Concurrent Resolution on the Budget for Fiscal Year 2018 (often referred to as the Tax Cuts and Jobs Act)	2018-2027	$1456	$1071	26
Protecting Family and Small Business Tax Cuts Act of 2018 (H.R. 6760)	2019-2028	$631	$545	14

Source: JCT.
Notes: The increases in the deficit are in nominal dollars and are drawn from reports published by JCT (2015b, 2015c, 2017, 2018b). The "Difference" column equals the conventional estimate less the dynamic estimate, divided by the conventional estimate.

I.F. Credibility of Estimates

The credibility of CBO's and JCT's estimates is crucial to the agencies' service to Congress and the country. Without agreed-upon numbers for budget discussions, policymaking would be less coherent and the budget process less effective, as emphasized to us by our discussant Deborah Lucas. The current level of agreement about numbers from CBO and JCT depends fundamentally on the credibility of the agencies' objectivity and methodologies—and maintaining that credibility may be especially challenging in the current era of amplified

polarization and heightened suspicion about expertise. Therefore, any potential changes in methodologies should be evaluated in part by whether such changes might diminish or enhance that credibility.

All else equal, CBO's and JCT's credibility is fostered by consistency over time in scoring methodology and by simplicity of scoring methodology. Members of Congress and their staffs should understand the key features of budget estimates, and they should not be expected to become economic experts because they are appropriately focused on the spending programs or tax code items that are their primary interests as well as the many other aspects of their jobs. Including additional behavioral responses in budget estimates would represent a change in estimating approach and would make those estimates more complex than otherwise.

However, "all else" is not generally equal. *Excluding* from budget estimates behavioral responses that members of Congress and their staffs expect to occur hinders the agencies' credibility, and when the agencies can draw on empirical evidence to include additional responses (of the conventional or dynamic sort), that inclusion can strengthen their credibility.

Indeed, the history of CBO's and JCT's analysis is *not* one of stasis in methodology or particular focus on simplicity. Instead, the agencies have made ongoing advances in their methodologies for producing conventional estimates, usually involving greater complexity, in order to improve the accuracy of estimates and expand the information presented. One prominent example is CBO's work in the early 2000s to strengthen its modeling and experience in analyzing health care policies, including requesting and receiving additional funding from Congress to bolster the agency's staff. As a result, the methodology of estimates during the debate about the Affordable Care Act was notably different and more complicated than the methodology of estimates of the Clinton administration's health reform plan fifteen years earlier. Another important example is CBO's expansion in the 2010s of its use of so-called fair value accounting for the government's financial activities, as a complement to the accounting approach specified by the Federal Credit Reform Act of 1990; see CBO (2012a, 2018). In addition, CBO's construction of its baseline projections has become more complex when developments have warranted it. For example, the agency's projections now incorporate much more primary data on immigration and rigorous analysis of immigration's effects on the economy and budget than previously.

As CBO and JCT have adopted increasingly sophisticated methodologies, the agencies have fostered transparency of their analytic approaches by devoting considerable attention to explaining what they do. Official budget estimates sometimes include substantial verbal descriptions, the agencies' leaders and staffs spend considerable time talking with members of Congress and their staffs, and the agencies publish separate reports documenting key methodologies. CBO's and JCT's openness about their methodologies is important for encouraging professional feedback and for showing that estimating approaches are grounded in evidence and are not "arbitrary or politically motivated" (CBO 1995, page 12).

Similar transparency would be essential for the additional behavioral responses and modeling that would be used in dynamic scoring. The agencies have already published numerous descriptions of their analytic approaches to labor, capital, productivity, output, and other economic measures, as well as of the application of those approaches to specific policy changes. For CBO, the key models include a Solow-type growth model, a Keynesian multipliers model, and a small-scale policy model that combines the two preceding models; those models are described by CBO (2014b, 2021b), Shackleton (2018), and Lasky (2022), among other references. For JCT, the key models include a macroeconomic equilibrium growth model, an overlapping generations model, and a dynamic stochastic general equilibrium model; those models are described by JCT (2015a, 2018a, 2020), Auerbach and others (2017), and Moore and Pecoraro (2020, 2023), among other references.

For future explanations of specific dynamic estimates, we can envision three types: Sometimes the additional behavioral responses would make little difference to the estimated budgetary impact and would not be of independent interest to policymakers; in those cases, little explanation of the additional responses would be needed. In other cases, the additional responses would matter consequentially for budgetary impact or would matter to policymakers for other reasons in ways that would follow standard patterns (for example, an increase in deficits would raise interest rates and thus debt service on existing debt); in those cases, the explanation would be provided by reference to existing published material. And in still other cases, the additional responses would matter and be somewhat idiosyncratic; in those cases, a bespoke and perhaps complex explanation might be required.

II. When?

In this section we address questions related to "when" dynamic scoring—or intermediate alternatives to conventional scoring—might be deployed. All of the considerations we discuss can evolve over time, which highlights the value of regularly reassessing these questions.

II.A. How Do Alternatives for Specifying the Deployment of Dynamic Scoring Compare?

If Congress wants to receive more information from CBO and JCT about the effects of potential policies on labor, capital, productivity, and other economic measures, we see four ways this objective could be reached—through more dynamic analyses apart from official budget estimates, through dynamic scoring for major legislation, through dynamic scoring for legislation in designated policy areas, or through a scoring approach that is intermediate between conventional and dynamic scoring. We take up these possibilities in turn.

First, Congress could ask CBO and JCT to increase the number and range of dynamic analyses they provide beyond the official scoring process. As we explained earlier, the agencies have published a substantial number of dynamic analyses covering different topics in recent years, and in doing so they have created new modeling tools and gained considerable experience in dynamic analysis. Many other dynamic analyses could be done in the future and would provide important information for policymakers and the public even if the analyses are not included in official budget estimates. Moreover, once an agency has completed a dynamic analysis in a policy area, the benefits and costs of including such analysis in budget estimates can be ascertained more readily.

Second, Congress could build on the current House rule requiring dynamic scoring for major legislation by adopting a similar approach in the Senate and by adjusting the definition of "major" so that more bills are covered. Because official budget estimates often receive particular attention during policy debates, this approach would give dynamic analysis more weight than if that analysis was made available just as ancillary information. Using dynamic scoring for proposals whose budget effects exceed a certain threshold has the advantage of focusing CBO's and JCT's efforts on proposals that generally would have larger effects on the economy as well as the budget. Also, using a dollar threshold provides a transparent trigger for dynamic scoring, and different thresholds could be chosen to trigger dynamic scoring more or less often. However, when a bill with budgetary effects large enough to trigger dynamic scoring includes many disparate components—which is often the case for major bills—doing dynamic scoring for all of

the components may be infeasible owing to a lack of prior investment by the agencies (because the policy areas that might arise in proposals exceeding thresholds are difficult to predict).

Third, Congress could adopt dynamic scoring for legislation in designated policy areas, which again would give dynamic analysis more weight than if that analysis was made available only as ancillary information. This approach would have the advantage relative to the "major legislation" approach of ensuring comparable estimates for alternative policies that Congress might consider for meeting a desired goal. Such comparability would be reinforced by applying dynamic scoring to both spending policies and tax policies in the chosen areas—for example, for federally funded R&D and for tax provisions affecting the after-tax price of private R&D. Moreover, CBO and JCT could focus their capacity-building investments on the chosen areas, which could enhance the quality and timeliness of subsequent estimates. However, applying dynamic scoring only to certain policy areas would be complicated to implement and explain when legislation combines proposals from different areas. In addition, focusing on certain policy areas would require decisions about whether proposals fall within those areas, which would not be straightforward in all cases; in other contexts in which classification issues arise (such as whether to apply the Federal Credit Reform Act), the agencies and congressional staffers have relied on written guidelines, frequent communication, and experience.

Fourth, Congress could choose a scoring approach that is intermediate between conventional and dynamic scoring. Following this path also would give dynamic analysis more weight than if that analysis was made available only as ancillary information, but the analysis would be more limited in some respects. Two sorts of intermediate approaches warrant particular attention:

- One intermediate approach that we discuss later in the paper is a "population change" approach to scoring that CBO and JCT have used in a few estimates of proposed changes in immigration policy. That approach adds to a conventional estimate the direct budget effects of changing the number of people in the country (through the impact on compensation and thus tax revenue) but not all the economic effects that likely would occur under a policy. The resulting estimates are less comprehensive than dynamic estimates, but they are more tractable and easier to explain because they do not include macroeconomic complexities. The population change approach applies naturally to changes in immigration policy, and it also could be applied to changes in health policy

that enabled people to live longer—for example, see the analysis by CBO (2012b) of the effects of raising the tax on cigarettes—and to changes in the legal system that affected the number of people who are institutionalized.

- Another intermediate approach that deserves further development is to include specific additional types of behavioral responses but not all the responses that likely would occur under a policy. For example, we noted earlier that changes in benefit programs would induce changes in both benefit take-up and labor supply and that only the former are captured in conventional scoring. What if budget scoring added expected labor supply responses, but not other responses that are currently excluded? For policies that would have direct effects on labor supply and no significant direct effects on capital or productivity (or direct effects on capital and productivity that have the same sign as the direct effects on labor), adding labor supply responses to budget estimates would tend to improve accuracy relative to conventional scoring. Many potential changes in benefit programs meet this criterion. However, for policies that would have direct effects on labor and direct effects on capital or productivity with the opposite sign, adding only labor supply responses to budget estimates could reduce accuracy relative to conventional scoring. Shifts in the tax burden between labor and capital meet this criterion. Therefore, an intermediate alternative of this sort would need to be implemented carefully.

We close this section by noting that if Congress was interested in more dynamic analysis through any of these mechanisms, CBO and JCT might not be able to fulfill every request because of practicalities such as time constraints.[7] Thus, the current congressional rule directing dynamic scoring for major legislation sensibly includes the phrase "to the extent practicable" (Lynch and Gravelle 2023, page 2).

II.B. What Specific Issues Arise with Appropriation Bills?

[7] In writing "if Congress was interested in more dynamic analysis," we are skipping over the notable complication that Congress rarely speaks with one voice. The committees that are most focused on CBO's and JCT's methodologies and allocation of effort are the House and Senate Budget Committees, the House Ways and Means Committee, the Senate Finance Committee, and the House and Senate Appropriations Committees. But other committees that rely on budget estimates sometimes have different views; resource levels for the agencies depend on the legislative branch subcommittees of the appropriations committees; and the leaders of the House and Senate sometimes have different views as well. In addition, of course, there can be partisan disagreements within each of these groups.

CBO produces budget estimates for appropriation bills—which determine annual funding for federal agencies, and which traditionally have covered most federal spending on investments like R&D and infrastructure—that focus on how quickly available funding would be spent (CBO 2023c, page 9). Those estimates do not include behavioral responses of the sort included in other budget estimates. In addition, certain sorts of feedback from appropriations to other parts of the federal budget are excluded from budget estimates by scorekeeping guidelines (as noted earlier) because including such feedback would complicate congressional processes.

Gullo and others (2025) comment on some of these issues in the context of R&D spending, and our discussant G. William Hoagland focuses on some of these issues in his remarks. Here we will only note that similar procedural issues have been addressed over time. For example, CBO sometimes has reported as a memo item but not added into the basic appropriation tabulations the estimated rise in tax collections from increased appropriations for enforcement, and on some occasions scorekeeping guidelines have been changed to make the information provided in estimates more useful to Congress. Analogously, the application of dynamic scoring to appropriation bills might take the form of memo items attached to basic tabulations that continue to exclude such effects, or it might engender changes in the scorekeeping guidelines.

II.C. What Factors Affect the Value of Investments in the Capacity for Dynamic Analysis?

As CBO and JCT invest in modeling and practice for dynamic analysis, the value of such investments in different policy areas depends principally on three factors in our assessment: the degree of interest from policymakers in considering policy changes; the strength of the research base about the impact of policies on labor, capital, and productivity; and the straightforwardness of modeling policy alternatives.

Working on topics of enduring interest from policymakers is valuable because of the fixed costs of developing the tools and experience to conduct dynamic analysis on a policy topic. Given the limitations of CBO's and JCT's resources, paying those costs is most worthwhile for topics where the long-term payoff is greatest. For example, past investments in modeling health proposals and the effects of fiscal policy have been in areas of sustained congressional interest.

Building capacity in policy areas with substantial research bases regarding effects that are excluded in conventional scoring is valuable because the credibility of estimates is enhanced when the agencies can point to clear evidence underlying their analytic approaches.

Investing in dynamic analysis for topics where modeling policy alternatives is straightforward is valuable because the time required for modeling varies greatly across topics. Dynamic analysis depends on both general macroeconomic modeling (for example, how changes in labor supply affect capital investment and interest rates) and modeling of specific policy provisions (for example, how various policy levers affect labor supply). The general macroeconomic modeling can be applied to many different types of policies, but the modeling of specific policy provisions may be bespoke. Therefore, the feasibility of dynamic analysis for a policy topic depends crucially on the complexity of modeling the leading policy alternatives.[8]

For topics where alternatives are denominated in standardized units such as dollars or numbers of people, and where effects scale roughly linearly over the relevant range, solid estimates made for some proposals can be scaled through simplified spreadsheets and rules of thumb to produce credible estimates for other proposals. Examples include federally funded research and immigration of higher-skilled people, and we return to those topics later.

For topics where the policy space is multidimensional because alternatives often involve different structures of policy, building simplified but still credible models is more challenging. For example, with health care and health insurance, the diversity and complexity of proposals makes conventional scoring quite difficult in many cases and dynamic scoring even more difficult. CBO and JCT provided a dynamic budget estimate for repeal of the Affordable Care Act (CBO 2015b) and have produced dynamic analyses of some other health proposals, including an increase in the tax on cigarettes (CBO 2012b) and an expansion of Medicaid eligibility (CBO 2024e). However, those examples do not demonstrate that the agencies could provide comparable analyses today for many other health proposals; indeed, the estimate for repeal of the Affordable Care Act quantified some influences on labor supply and saving but not others.

[8] Another challenge in doing dynamic analysis for some policies is capturing effects that occur far in the future. In select cases, CBO has provided numerical estimates or qualitative information about effects beyond the decade captured in the usual budget window and their feedback to the federal budget. For example, see the analyses of comprehensive immigration reform (CBO 2013a, 2013b) and a proposed change to Medicaid (CBO 2024e).

II.D. How Might the Foregoing Considerations Evolve over Time?

Advances in economic research and in CBO's and JCT's capabilities might affect the advantages and disadvantages of the different approaches discussed in the preceding sub-sections. For example, as the evidence base in the health area continues to expand and if CBO and JCT can make further improvements in their toolkits, the agencies may become better able to estimate the effects of policies on enhancing health and enabling a more productive workforce.

To improve both conventional and dynamic estimates, CBO and JCT could regularly publish "calls for research" on topics where a scarcity of evidence particularly hinders the agencies' work; one example is CBO's (2024b) article in the *Journal of Economic Perspectives*, which was solicited by one of the authors of the present paper (Williams) in her role as editor. In addition, there probably will be considerable "learning by doing" on the part of CBO and JCT, with positive spillovers among investments in different aspects of dynamic analysis. Therefore, it could be useful for the strengths and weaknesses of different approaches for budget estimates to be reviewed regularly, and decisions about the best approach might change over time.

III. How?

In this section, we draw on CBO's existing dynamic analyses to illustrate a process for "how" dynamic scoring might be done. JCT's dynamic analyses have been constructed somewhat differently, and we highlight one important aspect of JCT's approach below; for further information, see the references cited earlier.

III.A. Estimating direct effects of a proposal on labor, capital, and productivity

The starting point for a dynamic budget estimate is to assess the direct effects of a proposal on labor supply, saving and investment, and total factor productivity, leaving aside for the moment the financing of the policy. Those effects should be disaggregated into categories of labor with different marginal products and categories of capital with different gross marginal products and depreciation rates. The effects depend on responses by households, businesses, implementers of legislation in the executive branch, and state and local governments; for example, an increase in federal highway funding could spur reinforcing or offsetting changes in state highway funding. The effects need to be estimated with a time dimension: Conventional budget estimates reflect the fact that federal funding affects outlays with a lag, and dynamic

estimates should reflect also the fact that federal outlays may have lagged effects on labor, capital, and productivity. Capturing all the conceivable effects of a proposal on those economic factors is not possible, any more than capturing all the conceivable nondynamic effects is possible in a conventional estimate; the challenge for analysts remains to identify and include the effects that are likely to be most important and for which there is some basis for assessing the likely sign and magnitude.

As discussed earlier, investments in modeling and practice lower somewhat the marginal cost of future estimates because models and experience can be used repeatedly, in both conventional estimates and dynamic ones. But even when a model has been built and tested in a policy area, an analyst dealing with a new proposal in that area still needs to translate the proposal's legislative language into model inputs and review model outputs—and often undertakes this process many times as Congress iterates on alternative versions of the proposal. Therefore, producing dynamic estimates still will be more time-consuming than producing conventional estimates in most cases.

III.B. Estimating changes in output and other economic factors

With the estimated effects of a proposal on labor, capital, and productivity in hand, an analyst can estimate the follow-on effects of the proposal on potential output, actual output, interest rates, inflation, and other economic factors. We address three issues that arise in such estimates—effects on aggregate demand, the impact of different methods of financing, and the challenge of aggregation across different elements of a proposal.

First, a proposal can cause actual output to deviate from potential output through its effect on aggregate demand. Some proposals might change aggregate demand roughly in line with potential output, and for other proposals, the Federal Reserve would adjust short-term interest rates to bring aggregate demand into balance with potential output and keep inflation close to the Fed's target. Still, output, interest rates, and inflation might all change, and shifts in those economic factors affect the federal budget through tax collections, debt service, and other channels. Moreover, some proposals are *designed* to shift aggregate demand relative to potential

output, such as fiscal stimulus when economic activity is weak. Dynamic estimates include shifts in aggregate demand to capture those economic impacts.[9]

Second, including the effects of financing a proposal is crucial to generating a useful assessment of its economic impact. For example, consider an increase in federal investment financed by an increase in borrowing. Taking account of the positive impact on growth of the additional government investment without taking account of the negative impact of crowding out some private investment would be misleading. And if the net impact on growth is an increase, including the resulting positive impact on the budget without including the negative impact on the budget of paying higher interest rates on outstanding debt also would be misleading—especially because the current high level of debt means that changes in rates can have large effects on the government's fiscal position.[10]

For an illustration of both these points, consider CBO's (2021c) analysis of a potential increase in infrastructure spending. In the first scenario considered, additional infrastructure spending is offset by a reduction in some other form of government spending that does not constitute investment.[11] CBO estimated that this policy would have little imprint on output in the short run, a growing positive effect on output over time, and little effect on interest rates; overall, the economic effects of the policy would reduce the budgetary cost by about one-third. In the second scenario, additional infrastructure spending is financed by borrowing. CBO estimated that this policy would boost output for a while but have little effect in the long run (because the additional borrowing would crowd out some private investment) and would raise interest rates in both the short and long runs; overall, the economic effects of the policy would *increase* the

[9] The economic impacts of shifts in aggregate demand depend on underlying economic conditions—as do other aspects of dynamic analyses. The macroeconomic models used by CBO and JCT are aligned with CBO's baseline economic and budget projections and are updated as those projections evolve—just as all of the agencies' models are updated regularly to reflect the baseline projections and other information.

[10] Presumably a change in borrowing would be assumed to occur with the same maturity structure as outstanding debt. Some economic models imply that government budget deficits can be self-financing in certain circumstances so that additional debt imposes no burden. But in that case the whole purpose of budget estimates should be reconsidered; our maintained hypothesis in this paper is that deficits are not self-financing. Separately, long-term analyses of government borrowing face the question of how long debt can rise before changes in spending or taxes are needed to avoid economic instability—and assuming any future changes runs afoul of the principle that CBO and JCT should not predict policy changes. But even with the current high level of government debt, this question can be avoided or answered in a fairly neutral manner over the next few decades for most proposals.

[11] In CBO's analysis, the reduction in other government spending is implicitly assumed to have no economic effects.

budgetary cost by about one-fourth. These patterns—varying between financing methods and over time for either method—are important for policymakers to understand.

We note also that, by longstanding convention, CBO's budget estimates do not include debt service from changes in government borrowing: A proposal that would raise spending by $10 billion this year, leave spending unchanged in subsequent years, and make no change in taxes would be reported to increase deficits over the budget window by $10 billion, not $10 billion plus the interest costs that would be incurred later.[12] However, CBO's dynamic analyses do include the debt service that arises from changes in interest rates applied to the existing debt, which is what we are describing here; see CBO (2016, footnote 19) and CBO (2021c, footnote 5). Thus, a dynamic budget estimate of the hypothesized proposal would include the debt service stemming from higher interest rates applied to currently outstanding debt, but it would not include debt service on the $10 billion.

Third, aggregating different elements of a legislative proposal represents a significant challenge to dynamic analysis. Bills often are constructed in pieces, and multiple analysts at CBO and JCT often work on the estimate for a single bill. To produce a dynamic estimate for the spending bills on which CBO focuses, the pieces usually do not interact in significant ways, so conventional estimates of the pieces can be constructed in a modular fashion and added together for an overall conventional estimate. Suppose that analysts estimated for each piece not only the conventional effects but also the direct effects on labor, capital, and productivity, the resulting change in government borrowing, and the follow-on effects on other economic measures. Those dynamic estimates of the pieces could be added together for an overall dynamic estimate. For example, if a bill paid for extra spending for a chosen purpose by cutting other types of spending, the sum across the bill's provisions of all the financing impacts would be zero, and the sum of the impacts of all the provisions on labor, capital, and productivity would match the effects of estimating the impact of the bill as a package.

By contrast, for the revenue bills on which JCT focuses, there are often significant interactions between provisions, so neither conventional nor dynamic estimates can be

[12] CBO (2024c) addressed the possibility of changing this convention.

constructed piece by piece.[13] As a result, conventional estimates of bills that change the tax code often need to be produced holistically, and dynamic estimates are the same in that regard.

III.C. Estimating changes in the budget

Given the estimated effects of a proposed policy on labor, capital, output, interest rates, and inflation, the impact on the government budget can be estimated using CBO's usual methodology for budgetary feedback, as noted earlier.

III.D. Reporting the estimates

The first report of a budget estimate is often a private conversation between CBO or JCT analysts and staff members for a congressional committee that is developing a proposal. Because that estimate may influence the committee's further work, those staff members want to receive a close approximation to what the agencies would ultimately publish if the proposal was approved by the committee. Therefore, if that first report does not include the proposal's dynamic effects and those effects turn out to matter consequentially for the published estimate, then the iterative process of developing the proposal will have been based on potentially misleading information. But to include dynamic effects in early conversations would require CBO's and JCT's analysts to have a sense of those effects—which could be difficult to develop on tight timetables. This observation again highlights the value of standardized and simplified dynamic estimation approaches where such approaches are tractable and credible, because then more information on dynamic effects could be provided earlier in the proposal development process.

For published estimates, the estimating agencies often show conventional effects and dynamic effects separately and then added together, to maximize transparency. That approach has been taken by JCT for some time, and it was used, for example, in CBO's (2021c, table 3) dynamic analysis of infrastructure spending.[14]

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[13] One implication of these interactions is that the "stacking order" for tax provisions affects the estimated impact of each provision. For example, if a reduction in tax rates is combined with a strengthened minimum tax, the rate cut will cost more revenue and have larger dynamic effects if it is evaluated first than if it is evaluated second.

[14] Because Congress's budget process relies on point estimates, CBO and JCT focus on point estimates as well. And because estimates are not usually derived from probabilistic models, prediction intervals do not flow naturally out of the estimating process. But the agencies do develop and report prediction intervals on occasion, especially for dynamic analyses, and that information can be useful for policymakers; for example, see CBO's (2013b) report on the economic effects of comprehensive immigration reform.

IV. An Illustrative Example: Potential Changes in Immigration Policy[15]

Immigration policy is an important element of economic policy, ranging from specific issues such as green cards for STEM (science, technology, engineering, and math) workers to general topics like whether and how immigration rules should respond to slower growth of the domestic-born workforce. With conventional scoring, budget estimates of proposals to change immigration policy generally capture only the expected effects on federal spending and not the expected effects on federal revenue. By contrast, dynamic scoring and the intermediate alternative of population change scoring capture effects on revenue as well. In this section we compare these approaches to estimating the impact of immigration proposals.

IV.A. Conventional Scoring

Consider a proposal that would increase the number of immigrants. Under the conventional estimating approach of holding output fixed, the income earned by the new immigrants would be assumed implicitly to be offset by reduced earnings by other people, so there would be no estimated change in income or payroll tax revenue. However, the new immigrants would be modeled (appropriately) as receiving federal benefits for which they are legally eligible, such as the ACA's subsidies for health insurance, so there would be an estimated increase in federal spending. As a result, essentially any proposal that would increase the number of immigrants would be estimated to increase budget deficits.

Conventional scoring has been applied to most immigration proposals considered by Congress, and the resulting estimates have not provided a balanced picture of the likely impact of those proposals on the budget. Consider section 80303 of H.R. 4521, which was a provision in the America COMPETES Act to increase the availability of green cards for holders of advanced STEM degrees. Economic research shows that the federal income and payroll tax revenue generated by such immigrants would be much greater than the spending for federal benefits they would receive; for example, a 2017 National Academies of Sciences, Engineering, and Medicine report concluded that, on average, high-skilled immigrants contribute hundreds of thousands of dollars more in federal tax revenue than they receive in federal benefits over their working lives.

[15] This section draws in part on work by Elmendorf and Williams (2024), which was done in collaboration with Alex Arnon and Kent Smetters from the Penn Wharton Budget Model.

Yet, CBO (2022) reported that this legislative provision would *cost* the federal government $3.1 billion over a decade.

Note that conventional scoring of an immigration proposal relies on detailed modeling of how the proposal would affect the number and characteristics of people entering the country and of domestic residents who would change their legal status, which in turn could affect emigration, eligibility for federal benefits, and other outcomes like job changes and earnings.[16] The result of this population modeling can be visualized as a table of changes in the numbers of people with different combinations of attributes—and the table offers much of the information needed to go beyond conventional scoring.

IV.B. Population-Change Scoring

The estimating agencies do not always use conventional scoring for immigration proposals. In estimating the effects of S. 744, a proposal for comprehensive immigration reform, CBO (2013b, page 2) explained: Following the "long-standing convention" of "assuming that total employment was unchanged would imply that any employment of the additional immigrants would be offset one-for-one by lower employment elsewhere in the population. Because that outcome would be highly implausible, CBO and JCT relaxed the assumption of fixed GDP and employment and incorporated into the cost estimate their projections of the legislation's direct effects on the U.S. population, employment, and taxable compensation," which primarily affected the amount of additional tax revenue that would have resulted from enacting the bill. In other words, this proposal would so clearly change output that relaxing the conventional assumption of fixed output was the only reasonable way to proceed—and the assumption was then relaxed in the simplest and most straightforward way.

This population change approach incorporates all the elements of a conventional estimate as well as the direct budgetary effects of changing the number of people in the country—in particular, the effects on taxable compensation and therefore on income and payroll tax revenue.

[16] As an example, one of us (Williams) worked with Matthew Esche and Jeremy Neufeld on population modeling for a representative policy in the spirit of section 80303 and other recent proposals such as S. 2384 (the Keep STEM Talent Act of 2023). That representative policy would exempt from statutory limits employment-based green cards (EB-1, EB-2, and EB-3) for applicants who have earned a doctoral or master's degree in STEM at a U.S. research institution or foreign equivalent, as well as for an accompanying spouse and minor children. For the code and documentation for that population modeling, see Esche, Neufeld, and Williams (2024).

But population-change estimates do not incorporate all the likely economic effects of a proposal, as a fully dynamic approach would; we return to this issue shortly. To our knowledge, CBO has applied the population change approach to four legislative proposals over time: S. 2611 (CBO 2006), Senate Amendment 1150 to S. 1348 (CBO 2007), S. 744 (CBO 2013a), and H.R. 2131 (CBO 2014a); the first three proposals represented comprehensive immigration reform, and the fourth aimed to increase the number of visas for high-skilled noncitizens.

Two examples illustrate how markedly population change estimates can differ from conventional estimates:

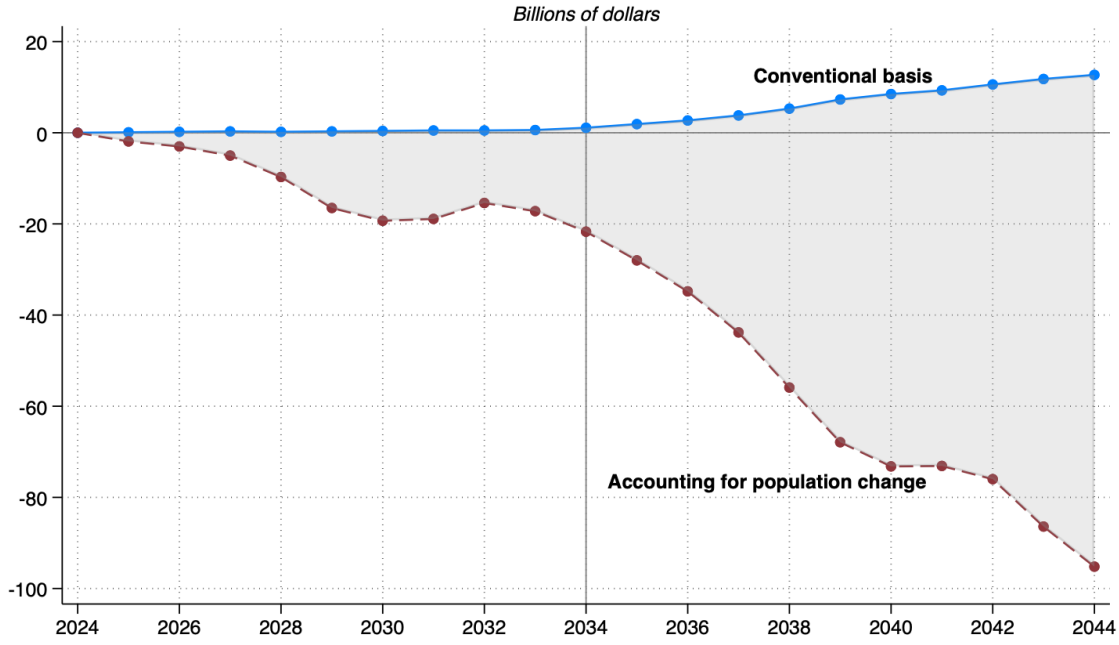
- Both H.R. 2131 and section 80303 of H.R. 4521 would have increased the availability of green cards to holders of advanced STEM degrees. CBO's conventional estimate for section 80303 showed an increase in budget deficits of $3 billion from 2022 to 2031, whereas CBO's population change estimate for H.R. 2131 showed a decrease in budget deficits of $110 billion from 2014 to 2024.
- Elmendorf and Williams (2024) compared conventional and population-change estimates for a section 80303-style proposal. Figure 2 summarizes their estimates of the effects on budget deficits over the next twenty years. The conventional estimate (the solid line) shows a slight increase in deficits, while the population change estimate (the dashed line) shows a decrease in deficits that grows significantly over time as lawful permanent residents naturalize and sponsor family members, with an assumed nine-year lag, following Carr and Tienda (2013).

A natural follow-up question is how much conventional and population-change estimates would differ for immigration proposals that involved a broad cross-section of immigrants, whose average taxable compensation would be lower than that of high-skilled immigrants and whose average take-up of federal benefits would presumably be higher. CBO's recent update to its baseline economic and budget projections provides an answer. CBO (2024d) explained that a surge in immigration that occurred during 2022 and 2023 (and that CBO expected to continue to some extent for a few more years) comprised people who are much less educated, on average, than holders of advanced STEM degrees.[17] CBO expected that about half of this group will

[17] CBO attributed the surge in immigration to people who are entering the country without inspection, who were allowed to enter the country lawfully through parole authority and are awaiting proceedings in immigration court, or who previously resided in the country under a temporary legal status and remained after that status expired.

receive authorization to work; some of the other half may work as well, but immigrants who work without authorization are less likely to pay taxes. CBO estimated that, over the next decade, the surge in immigration will increase federal revenue by $1.2 trillion (mostly from additional income and payroll taxes) and increase federal spending by $0.3 trillion (mostly from additional federal benefits), for a net reduction in deficits of $0.9 trillion. Those figures suggest that legislative proposals that changed the number of less educated immigrants probably would receive starkly different population change estimates and conventional estimates.

Figure 2. Estimated effects on the primary deficit of an increase in green cards to holders of advanced STEM degrees, conventional and population change approaches



Source: Reprinted from Elmendorf and Williams (2024, figure 1), reflecting estimates produced by the Penn Wharton Budget Model.

A further question is whether population change estimates—estimates that include the effects of immigration proposals on revenue as well as spending—can be produced in reasonable timeframes. One approach is for the estimating agencies to apply a microsimulation model for taxes to the estimated changes in numbers of people with different attributes that are generated currently for conventional scoring. Because the attributes needed to predict employment and compensation are similar to those needed to predict benefit eligibility, this approach would work

fairly well—but still would be time-consuming. An alternative approach is for the estimating agencies to calibrate and use a microsimulation model each time that baseline projections are updated, apply the results to create a "calculator" with changes in revenue per person for each combination of attributes in the population modeling, and use that calculator for all proposals until the baseline projections are updated again. This approach would allow for shorter turnaround times than running a microsimulation model for each request, and two of us (Elmendorf and Williams) are exploring this method in joint work with Theresa Gullo.

IV.C. Dynamic Scoring

Population change estimates capture more effects of immigration proposals than do conventional estimates, but they do not capture all the effects that would be included in dynamic estimates, such as potential changes in capital investment, interest rates, productivity, and more. CBO has produced dynamic analyses of two legislative proposals on immigration—S. 2611 (CBO 2006, appendix) and S.744 (CBO 2013b)—that were separate from the official budget estimates for those bills. CBO (2024d) used an analogous approach to update the agency's baseline projections for the immigration surge.

Space constraints do not allow us to discuss all the economic effects of changes in immigration policy, so for illustrative purposes, we comment on just one effect that was featured in CBO's baseline update—the impact of immigration on productivity. A number of papers present compelling evidence that when high-skilled immigrants move to the United States, their research becomes more productive (Prato 2025), they generate valuable innovations at disproportionately high rates (Bernstein and others 2022), and they start new firms that lead them to act more as "job creators" than "job takers" of domestic residents (Azoulay and others 2022); few papers link these innovation-related outcomes directly to productivity, although Peri (2012) and Prato (2025) are two exceptions. CBO (2024d, page 19) estimated that 3 percent of people in the immigration surge are high-skilled STEM workers. That is a small percentage, but it represents a large absolute number—several hundred thousand people, which exceeds the statutory annual cap on H-1B visas. CBO estimated that those workers will contribute to innovation-related activities that raise total factor productivity roughly 0.3 percent by 2034 relative to what it would have been otherwise, boosting output and income for decades to come. However, CBO also estimated that lower average educational attainment and fewer years of

work experience in the surge population relative to domestic workers would pull down productivity by a roughly offsetting amount in 2034.

Constructing a dynamic estimate of an immigration proposal that incorporates all the potential economic and budgetary effects requires considerable modeling, as demonstrated by the complexity of the analysis that CBO reported for its baseline update. Hence, a natural question is what share of the overall budgetary impact of a proposal could be captured by a simpler population change estimate. The answer would vary across legislative proposals, of course, but one datapoint is available: CBO estimated that the immigration surge will reduce deficits over the next decade by roughly $600 billion through only the change in population and its direct effects on revenue and spending, and by an additional nearly $300 billion when incorporating all of the dynamic effects. If the surge had been the result of a legislative proposal, a population change estimate would thus have captured about two-thirds of the budgetary impact captured by a dynamic estimate.

V. Illustrative Examples: Potential Changes in Federal Investment and Federal Permitting of Investment

Federal investments in infrastructure, education, and R&D are made with the intention of increasing physical capital, human capital, and productivity—and thereby spurring economic growth. CBO has examined the economic impact of federal investment but has never included that impact in official budget estimates. In this section, we explore potential dynamic scoring for federal investment and federal permitting of investment.

V.A. CBO's 2021 Report on Physical Infrastructure Spending

CBO has analyzed the effects of federal investments for some time (for example, see CBO 2013c, 2016), and it made a substantial further advance in its 2021 report on "Effects of Physical Infrastructure Spending on the Economy and the Budget Under Two Illustrative Scenarios" (CBO 2021c). The report was prepared in response to a request from then Senator Rob Portman, who wanted to bring a more comprehensive analysis to bear in developing the bipartisan Infrastructure Investment and Jobs Act (Bolton 2021).

The 2021 report effectively describes how CBO could produce a dynamic estimate of a proposal to change federal infrastructure spending if Congress requested it. The report is

exemplary in its rigorous analysis and methodological transparency. Moreover, the modeling is presented in a modular and flexible fashion, so it could be applied readily to a variety of specific proposals. The report focuses on five key factors:

- *How state and local governments respond to additional federal funding:* Additional federal spending on infrastructure is expected to induce a partially offsetting reduction in infrastructure spending by state and local governments. For other types of federal investment, the expected response of state and local governments to a federal policy change could be different; moreover, other federal investments might spur an offsetting or reinforcing response by private actors as well.
- *How quickly funding leads to outlays:* Federal spending generally lags the authorization to undertake spending, to a degree that varies across types of spending. This factor is a standard aspect of CBO's conventional estimates, so including it in dynamic estimates would be straightforward.
- *How quickly outlays increase productivity:* CBO expects that additional federal infrastructure spending would increase productivity with a lag, with 40 percent of the effect occurring in the first year, 80 percent by the second year, and 100 percent by the seventh year. For other types of federal investment or for specific types of infrastructure spending, different lagged patterns might be appropriate and could be drawn from the research literature.
- *How much outlays increase productivity:* CBO expects that federal infrastructure has a gross annual return of 12.4 percent and depreciates by 3.2 percent annually, implying a net annual return of 9.2 percent. Again, different figures could be appropriate for different types of federal investment.
- *How outlays are financed:* As we described earlier, CBO examines two scenarios—one in which the additional infrastructure spending is financed by cuts in other spending that does not directly affect productivity, and one in which the additional spending is debt financed. With these two scenarios modeled, CBO could model an intermediate financing approach as well.

In sum, this modeling approach could be applied to a change in any federal investment for which there is a reasonable basis for determining these five factors. The most challenging factors to ascertain are the third and fourth regarding the effects of federal investment on

productivity, and we turn to this challenge in the context of R&D spending shortly. More generally, the evidence base on the economic effects of federal investments will improve over time, and as it does, the feasibility and value of dynamic estimates will improve as well.

V.B. Application to Potential Changes in Federal Spending for Research and Development

For federal spending on R&D, the research literature is sufficiently developed that CBO's 2021 framework for analyzing federal infrastructure spending could be applied in a fairly straightforward way. One of us (Williams) has worked with Theresa Gullo, Benjamin Page, and David Weiner (Gullo and others, 2025) to illustrate how that analysis could be done, so we refer interested readers to that paper and summarize the main points here.

For decades, economists have explored the effect of investments in research and innovation on economic growth; for example, see Romer (1990), Grossman and Helpman (1991), and Aghion and Howitt (1992). However, empirical evidence on the relationship between R&D and productivity growth has come slowly. Jones and Summers (2022) applied a somewhat indirect macroeconomic approach to infer that the marginal social return to R&D tends to be high (see their table 7). Azoulay and others (2019) and Myers and Lanahan (2022) estimated the spillovers from R&D funded by the National Institutes of Health and the Department of Energy, respectively, and found that the spillovers are substantial within a decade; however, neither of these papers quantified the effects of R&D on productivity.

Fieldhouse and Mertens (2024) and Dyèvre (2023) offered a key step forward, essentially stitching together the microeconomic evidence on returns to R&D with macroeconomic aggregates. Using quite different empirical approaches, these papers arrived at broadly similar quantitative estimates of the contribution of federal R&D to productivity. For example, Fieldhouse and Mertens used a narrative approach to classify postwar changes in appropriations for R&D at five major federal agencies and then used those data to make structural estimates of the economic returns to those appropriations. They concluded that the returns are between 140 and 210 percent, which implies that federal R&D has been responsible for at least one-fifth of overall postwar growth of total factor productivity in the United States.[18]

[18] The research literature distinguishes between defense and nondefense R&D. CBO (Campbell and Shirley 2018) argued that most defense R&D does not provide significant spillovers to the private sector, although there are exceptions, and therefore defense R&D does not substantially influence the agency's economic analysis. Recent

Gullo and others (2025) discuss how to apply this evidence in CBO's 2021 framework to analyze the economic and budgetary impact of changes in federal R&D investment. For example, to address some of the key factors identified by CBO: The research literature suggests that federal R&D crowds in private R&D, Fieldhouse and Mertens' (2024, figure 6) estimated impulse response functions provide a basis for projecting time lags between R&D and productivity, and the Bureau of Economic Analysis has done extensive work on depreciation rates for R&D.

Because much of federal R&D can be denominated readily in dollars and probably has effects that scale roughly linearly over relevant ranges, modeling the effects of changing federal R&D in simplified ways could produce informative estimates. For example, one could imagine a spreadsheet with estimated effects on the economy and the federal budget of each dollar of additional funding through different agencies (say, the National Institutes of Health versus the National Aeronautics and Space Administration) and for different purposes (say, basic research versus applied research). A tool like this could be updated with each baseline and provide a tractable way to produce dynamic budget estimates on compressed timelines. In addition, investments in piloting, validating, and improving this approach could provide a template that could be applied over time in other policy areas.

V.C. Application to Potential Changes in Federal Permitting for Physical Infrastructure

For potential changes in federal permitting for infrastructure, CBO's 2021 framework seems appropriate for doing dynamic analysis—but the available research base for informing key parameters of *conventional* estimates (and therefore also dynamic estimates) is lacking. CBO's (2024b) description of the disconnect between the agency's modeling capability and the available research on this topic may spur additional research. As the research literature develops over time, the ability to produce rigorous budget estimates will improve.

In recent years Congress has been interested in the processes through which infrastructure projects are licensed, or "permitted," before construction occurs. The National Environmental Policy Act (NEPA), which was enacted in the 1970s, can be viewed as an umbrella statute for compliance with a broad set of federal, state, local, and tribal permitting policies. NEPA covers

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research generally supports that position. More broadly, CBO (2014c) explored the impact of federal policies on innovation.

both federally funded and federally subsidized projects (except in cases where the government exercises no discretion when awarding the funding, as with, for example, the Department of Housing and Urban Development's Housing Trust Fund, where the resources are dispersed to states to allocate). As discussed by Liscow (2025), the goal of NEPA is to force review of how proposed projects would affect the "environment," including both nature and people. Potter, Datta, and Stapp (2022) argued that the NEPA permitting process is hindering other national priorities such as a clean energy transition and therefore should be restructured.

To estimate the economic and budgetary effects of potential changes in NEPA, several factors are relevant: First, would the changes shorten the timeline on which infrastructure projects are built? Second, if so, how many more infrastructure investments would occur within a given timeframe (including both the acceleration of projects that would occur anyway and the pursuit of new projects)? And third, how would the additional projects affect the economy and the federal budget?

The first and second questions matter for conventional budget estimates, and the third question would need to be addressed for dynamic estimates. For the third question, CBO's 2021 framework applies directly to federally funded investments, and that framework together with CBO's standard modeling of the effects of private capital can be applied to federally subsidized private investments. In contrast, for the first two questions, the available research base is much more limited—which hinders CBO's ability to produce conventional estimates as well as dynamic estimates.

Consider a proposal aimed at reducing time to build by shortening the NEPA permitting process. To produce a conventional cost estimate, CBO would first need to quantify the additional spending on infrastructure that would occur within the budget window and the budgetary impact of that additional spending. For example, CBO would try to assess the extent to which organizations that opposed infrastructure projects could prevent an acceleration of permitting by shifting their attention to processes imposed by state, local, or tribal governments. Then CBO would need to assess the elasticity of infrastructure projects with respect to changes in time to build. This elasticity is conceptually straightforward: Shortening permitting time is analogous to shortening commercialization lags for new pharmaceutical drugs, which one of us (Williams) estimated with co-authors to have increased private investment in drug development (Budish, Roin, and Williams 2015). Unfortunately, we are aware of no empirical literature that

could inform such an assessment; in the words of CBO's (2023a, page 3) cost estimate for H.R. 1, the Lower Energy Costs Act: "CBO has insufficient information to determine the number of projects … that could be generated."

VI. Conclusion

In recent years Congress has asked its official estimators—CBO and JCT—to provide more information about the economic effects of policy changes. The agencies have responded by drawing on an expanding body of economic research, improving their modeling tools, gaining experience at such analysis, and publishing reports regarding their methodologies and results. This work has reinforced the value of the agencies providing unbiased, evidence-based analyses of the effects of potential policies on labor, capital, productivity, output, and other economic measures.

Decisions by Congress about the extent to which such analysis should be included in official budget estimates—through dynamic scoring or intermediate alternatives to conventional scoring—involve trade-offs regarding time, resources, accuracy, and comparability. With labor force growth slowing and federal debt rising, interest in the intersection of public policy, economic outcomes, and budget impacts shows no signs of diminishing.

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