



Legislative Council Staff
Nonpartisan Services for Colorado's Legislature

Memorandum

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TO: Interested Persons

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SUBJECT: Dynamic Modeling

Summary

A *dynamic model* attempts to quantify the downstream effects of a policy change throughout the economy. Legislative Council Staff (LCS) does not conduct dynamic modeling, which means that fiscal notes and other analyses are limited to the scope of legislation's direct impacts and, in some cases, direct behavioral effects. This memorandum explains the difference between direct, behavioral, and dynamic effects of policy changes and current LCS practices in analyzing these impacts.

Direct, Behavioral, and Dynamic Impacts

Legislation can be said to have direct, behavioral, and dynamic fiscal impacts. A definition and example of each of these is presented below.

Direct impact. The direct fiscal impact of a policy change is the immediate costs or savings that it causes in the state budget. For example, a bill to increase the value of an existing income tax credit will result in two direct impacts: (1) the expenditure of state funds to program the change in state computer systems and update state tax forms; and (2) reduced state revenue because taxpayers who would already have claimed the tax credit are able to access a larger tax benefit.

Behavioral impact. A policy change may have a behavioral fiscal impact if it directly motivates actors in the economy to behave differently. For example, a bill to increase the value of an existing income tax credit may result in a behavioral impact if the enhanced tax benefit motivates more taxpayers to take the action that the credit rewards. In this case, state income tax revenue would be reduced because of the greater number of tax credits claimed, and administrative costs would increase as necessary to accommodate the additional caseload.



Dynamic impact. A policy change's dynamic fiscal impact encompasses all of its downstream effects throughout the economy. These effects occur over secondary, tertiary, and subordinate behavioral and economic changes.

For example, a bill to increase the value of an existing income tax credit results in lower tax liability for affected taxpayers. With higher post-tax income, these taxpayers may spend more on goods and services, increasing income to certain businesses. In addition to paying higher taxes as a result, affected businesses may also invest in new research and development and hire more employees. As a result of new hiring, the labor market may tighten, causing wages to increase, while also increasing unemployment insurance contributions by employers, and so on.

Expanding a tax credit will also reduce tax revenue to the state, causing a corresponding loss of economic activity. The revenue decrease reduces funds available to be spent for state services, impacting existing state programs and employment opportunities, incomes, and consumption among public sector or state government contract employees. Beneficiaries of government services that receive less funding may face increased costs that exceed any reduction in their tax bill. A dynamic model would account for the cumulative downstream impacts and trade-offs of these considerations.

Impacts Identified in Fiscal Notes and Other LCS Analyses

LCS fiscal notes and related analyses are intended to identify the fiscal impacts of legislation for state and local government budgets. Generally, these analyses account only for the **direct impacts** of legislation.

In certain circumstances where data or other information are available, LCS may qualify or quantify the fiscal impacts of **behavioral changes** expected to result from legislation. In order to do so, LCS must be able to rely on credible, well-established, and unbiased data or information concerning behavioral changes. In some cases, behavioral changes in response to a particular type of policy change are well-documented and can be used. In others, staff may be able to infer estimates using unbiased information about the effects of similar policy changes in other jurisdictions. In many cases, data do not exist to quantify behavioral changes that will result from a policy change.



LCS does not currently employ dynamic modeling, and fiscal notes and related analyses do not attempt to quantify **dynamic impacts**.¹ Employing dynamic modeling is a time-intensive process that is not suitable for all legislation due to the time-limited nature of the legislative session. The next section of this memorandum provides additional context and considerations for dynamic modeling and its uses in analyzing the impacts of legislation.

Dynamic Modeling Review and Limitations: Experiences of Other States

Several states have used dynamic models for some of their fiscal analyses.² Analysts in these states have found limitations to dynamic modeling, and some states have discontinued its use. States currently using dynamic models generally do so sparingly to compare or evaluate major tax policy changes, such as a sales tax or income tax rate change. Most states do not use dynamic modeling for fiscal note purposes due to the time demands and costs required to produce dynamic estimates. The following provides a list of considerations for and limitations of the use of dynamic modeling.

1. **Offsetting impacts.** States that have used dynamic models have generally found that policy changes result in smaller dynamic fiscal impacts than expected. Because the state must maintain a balanced budget, dynamic fiscal impacts will always occur on the margin, in that they will depend on whether or not the dynamic economic gains resulting from a policy change exceed the dynamic economic losses. Whether the marginal impact is negative or positive depends on the strength of the behavioral and economic response to the policy. Quantifying this is complicated by the fact that it is impossible to know how the state would have chosen to use its resources if the policy change had not been enacted.
2. **Timing.** Dynamic fiscal impacts can take several years to fully materialize. However, the direct fiscal impacts of legislation must be addressed immediately within the state budget.

¹ Conditional on the receipt of \$120,000 in gifts, grants, or donations, LCS is required under current law to establish a pilot program for the purpose of developing or procuring a dynamic model to analyze the economic impacts of bills introduced by the General Assembly (Section 2-3-304.5, C.R.S.). To date, LCS has not received sufficient funds to trigger the pilot program requirement, and a pilot program has not been developed.

² For a review, see: Bluestone, Peter, and Carolyn Bourdeaux (2015). "Dynamic Revenue Analysis: Experience of the States." Georgia State University, Center for State and Local Finance, and Fiscal Research Center. Available at: https://cslf.gsu.edu/files/2015/04/Dynamic-Revenue-Analysis_April2015.pdf



3. **Out-of-state leakages.** Money spent by the state is usually directed toward programs and individuals within the state, while the private sector is not constrained by state borders. "Leakage" often occurs, for example, if the economic effects of a policy change ultimately accrue to out-of-state actors.
4. **Crowding out.** Dynamic models must account for instances where the government's provision of a service will crowd out private actors providing the service in the status quo or, potentially, private actors that would rise to meet the demand for the service absent government action.
5. **Costs and complexity.** Dynamic models are expensive, and staff lacks confidence that they are either an accurate representation of the economy or capable of presenting fully unbiased output. Dynamic models rely on thousands of assumptions about human behavior and economic linkages, some of which may require normative judgements. In addition, the models rely on a large quantity of data that can be limited, inaccurate, or subject to frequent revisions. Further, the models are generally not detailed enough to address specific policy changes. If a dynamic model is not built to accommodate a narrow policy change, a user is required to convert the policy change into inputs that the model can process. Any error in the assumptions used for the inputs is compounded through the model.
6. **Inability to measure accuracy.** The complexity of the economy prevents the accuracy of a dynamic fiscal impact estimate from being measured in the future. The outcomes of the policy change cannot be differentiated from the outcomes of simultaneous changes in social behavior, other laws, and the business cycle. This prevents relational comparisons between actual and estimated dynamic impacts.