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Fair-Value Cost Estimation and Government Cash Flows

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Abstract

Under current law, federal agencies estimate the budgetary costs of loans and loan guarantees using the projected yields on Treasury securities to discount future cash flows to the present. That approach recognizes costs when loans originate instead of when cash flows occur, the approach agencies use to account for most other items in the federal budget. Agencies project the future cash flows of loans and loan guarantees as the average of their possible values, weighting different outcomes by their probability. Fair-value budgeting—an alternative to the approach used under current law—measures the costs of loans and loan guarantees more comprehensively by using market prices. Fair-value estimates incorporate market risk, the cost associated with the tendency of assets to perform well when the economy is strong and poorly when the economy is underperforming. People place greater weight on scenarios in which the economy is underperforming. As a result, negative deviations from the average amount of future cash flows outweigh positive deviations if market participants consider the risks associated with future outcomes. Market risk can be understood as the difference between two weighted averages of the same set of possible cash flows. Fair values reflect cash flows that are weighted by the value market participants would place on different scenarios.

Keywords: federal credit programs, fair value, discounting, uncertainty

JEL Classification: G00, H50, H81, H83

The federal government supports home ownership, postsecondary education, and certain other private activities through direct loans and loan guarantees. Federal agencies calculate the present value of the expected future cash flows of loans and loan guarantees by discounting them using the rates on Treasury securities with similar times to maturity.[1] The agencies then project future cash flows using average default and prepayment rates that weight different outcomes by their probability of occurring. For example, a projection of the cash flows of business loans incorporates the possibility of a recession by estimating the average number of businesses that default in recessions and then weights those higher default rates by the probability that a recession will occur. That approach, which is prescribed by the Federal Credit Reform Act of 1990 (FCRA), is sometimes known as the FCRA approach.

An alternative to FCRA accounting is fair-value accounting, which measures the cost of federal loans and loan guarantees on the basis of market prices. In fair-value estimates, loans are worth less than they would be in a FCRA estimate. Similarly, loan guarantees constitute a greater liability under the fair-value approach than under the FCRA approach. The Congressional Budget Office views the fair-value approach as a more comprehensive measure of the costs of loans and loan guarantees than the FCRA approach because the fair-value approach incorporates market risk, which measures the greater value that investors place on cash flows when the economy underperforms.[2] Because people generally place a higher premium on avoiding losses than on making gains, investors place more weight on bad economic outcomes than their probability of occurring would suggest. Some analysts argue that the federal budget should not account for market risk, in part because in their view it is not a component of the cash flows to and from the government. They point out that the fair-value approach ultimately records greater outlays than the underlying cash flows produce, on average.[3]

In CBO's view, fair-value estimates are a valuation in advance of the government's cash flows that incorporates the market risk of those cash flows. Historically, CBO has estimated fair value by discounting average cash flows with the rate on Treasury securities of similar times to

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[1] Present value is a single number that expresses a flow of revenues or outlays over time in terms of an equivalent lump sum received or paid at a specific point in time.

[2] See Congressional Budget Office, *Measuring the Cost of Government Activities that Involve Financial Risk* (March 2021), www.cbo.gov/publication/56778.

[3] See Government Accountability Office, *Credit Reform: Current Method to Estimate Credit Subsidy Costs Is More Appropriate for Budget Estimates than a Fair Value Approach,* GAO-16-41 (January 29, 2016), www.gao.gov/products/GAO-16-41; Paul N. Van de Water and Joan Huffer, "House 'Budget Transparency' Bill Would Make Budget More Opaque" (Center on Budget and Policy Priorities, June 18, 2013), https://tinyurl.com/53txdjxc (186 KB); and David Kamin, "Risky Returns: Accounting for Risk in the Federal Budget," *Indiana Law Journal,* vol. 88, no. 2 (Spring 2013), pp. 723–772, www.repository.law.indiana.edu/ilj/v0188/iss2/9.

maturity plus a premium that reflects market risk.[4] However, fair value can also be calculated by incorporating market risk in the cash flows themselves rather than in the discount rate.[5] (Market risk relates to uncertainty in cash flows at each point in time rather than to the time value of money.) Market risk is the difference between the way the fair-value approach and the approach applied under FCRA weight the set of possible cash flows at each point in the future to generate a single estimate. The fair-value approach weights cash flows in different future scenarios by the importance that investors place on those scenarios when pricing financial assets. The finance literature refers to such weights as "state prices."[6] In contrast, the average cash flows that agencies project under the FCRA method weight different outcomes by their probability of occurrence.

Market Risk Under Fair-Value and FCRA Estimates

The fair value of a loan or loan guarantee is a single value of the possible future cash flows that applies to all investors in a market. All investors pay the same market price for loans or charge the same price for loan guarantees, regardless of those investors' circumstances or cost of financing those loans and guarantees. Therefore, the value of a loan or cost of a loan guarantee is a function only of its characteristics, including its market risk.

Market risk in loans and loan guarantees arises from uncertainty about default rates, prepayment rates, and other outcomes that depend on the future state of the economy. For example, when the economy is weak, borrowers suffer financial strains, and the likelihood of default rises for all borrowers. As a result, diversifying a portfolio by pooling the loans of many borrowers cannot eliminate market risk.

The federal government can redistribute market risk among its stakeholders but cannot eliminate it. The government's stakeholders include everyone who pays taxes or benefits from government

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[4] See Congressional Budget Office, *How CBO Produces Fair-Value Estimates of the Cost of Credit Programs: A Primer* (July 2018), www.cbo.gov/publication/53886.

[5] For direct loans, the adjusted discount rate is applied directly to loan payments after adjusting for the cost of default. For loan guarantees, the adjusted discount rate is used somewhat differently. A standard approach to calculating the fair value of a loan guarantee relies on an estimate of the difference between the fair value of the loan with and without the guarantee. In the case of a full guarantee, the government essentially transforms a loan with a risk of losses from default into a loan with that risk removed. Under the fair-value approach, the adjusted discount rate is applied to the loan without the guarantee, and the projected yield on Treasury securities is applied to the loan that has the guarantee. See Congressional Budget Office, *How CBO Produces Fair-Value Estimates of the Cost of Credit Programs: A Primer* (July 2018), pp. 8–9, www.cbo.gov/publication/53886.

[6] See Kenneth J. Arrow and Gerard Debreu, "Existence of an Equilibria for a Competitive Economy," *Econometrica,* vol. 22, no. 3 (July 1954), pp. 265–290, https://dx.doi.org/10.2307/1907353.

programs.[7] Stakeholders also include people of future generations who would bear the future cost of debt. When government activities are more costly than projected, the government's debt is greater than it would otherwise be. That greater debt affects government stakeholders, either by acting as a drag on the economy or by inducing increases in taxes and cuts in benefits that are aimed at reducing the debt.

Estimates generated under FCRA do not incorporate market risk. They capture average rates of default for different economic states, including bad ones, but fail to account for the importance investors place on outcomes when the economy is weak. FCRA requires that the federal government estimate the cost of credit programs on a present-value basis, which differs from the cash-accounting approach federal agencies use for almost all other activities. Under FCRA, government agencies project cash flows as the statistical mean (weighted average) of the possible values of those cash flows and discount those flows to the present at rates for Treasury securities with similar times to maturity. Before FCRA became law, the cost of credit programs was measured on a cash basis.

A fair-value approach measures cost using the price a private investor would require to make loans and loan guarantees that are similar to those made by the federal government. That cost generally exceeds the FCRA estimate because private investors require compensation for market risk. On an annual basis, CBO compares the fair-value cost of credit programs with the estimates generated under FCRA. The agency has also used fair-value budgeting to estimate the cost of programs such as the Troubled Asset Relief Program.

Market Risk and the Cash Flows of Credit Assistance Programs

To calculate fair value, analysts usually add a risk premium to the rates for Treasury securities to incorporate the cost of market risk into discount rates. Although that approach is generally the easiest to apply, it does not reflect the point in the estimation process at which market risk is a concern. Market risk results from uncertainty in cash flows at each point in the future; it is not related to the relative value of money at different points in the future. Fair value can also be calculated by incorporating market risk in the cash flows themselves instead of in the discount rate. The two approaches yield the same answer if applied properly.

Two Approaches to Estimate Fair Value

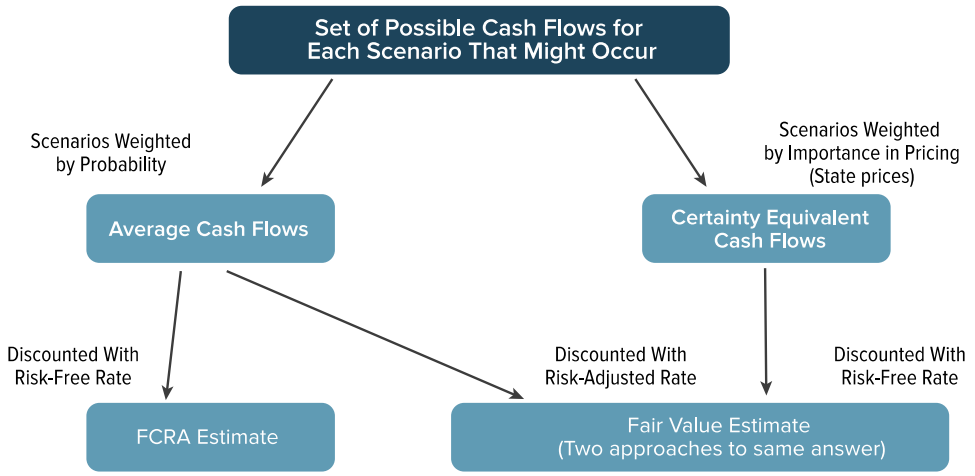
Incorporating market risk in the discount rate and in cash flows are two equivalent approaches to calculating fair-value estimates. Under the first approach—incorporating market risk in the discount rate—a statistical average represents the set of possible cash flows at each point in the

[7] Many investors are foreigners and thus have no stake in U.S. government, and many government stakeholders do not participate in financial markets, either because they belong to future generations or because they lack sufficient wealth. A forthcoming paper will address conceptual issues involved in using prices from financial markets to capture the preferences of government stakeholders regarding market risk.

future. Those averages are discounted to the time the loan is made with a market (risk-adjusted) rate of return. The market rate of return would usually be higher than the rate for Treasury securities (which are considered risk-free) to reflect the compensation investors receive for market risk. Under the second approach—incorporating market risk in cash flows—the projected cash flow at each point in the future is adjusted for market risk, and projected cash flows are discounted to the present using the rates for Treasury securities. Call the first approach "the market discount rate approach" and the second "the market cash flow approach." The approaches are two ways of getting to the same answer. In contrast, the FCRA approach incorporates market risk in neither the cash flows nor the discount rate (see Figure 1).

Figure 1.

FCRA and Fair-Value Estimates of the Cost of Federal Loan Programs



FCRA = Federal Credit Reform Act of 1990.

Data source: Congressional Budget Office.

Under FCRA, agencies project the future cash flows of loans and loan guarantees as the average of their possible values, weighting different outcomes by their probability, and discount future cash flows to the present using Treasury rates. Fair-value budgeting measures the costs of loans and loan guarantees with weights that are consistent with pricing in financial markets.

The risk-adjusted rate is the rate on Treasury securities plus a premium to compensate for market risk. The risk-free rate is the rate on Treasury securities.

In developing a fair-value estimate, analysts usually choose the most convenient approach. The market discount rate approach is more convenient when average cash flows are easily estimated or already available and is the approach most often used by CBO. Federal agencies that administer credit programs already calculate average cash flows for FCRA estimates. However, the market cash flow approach can be more convenient in other situations, such as cases in which option pricing models can be used to estimate the cost of an obligation. They develop cash flows

that incorporate market risk and discount them to the present at the risk-free rate for Treasury securities.[8] For example, CBO used an options pricing technique to estimate the fair value of loan guarantees and warrants issued to airlines because the inputs to a common formula for warrant prices were readily available, whereas determining the cash flows of the warrants would have required additional analysis.[9]

Determining the Equivalence Between Market Discount Rates and Market Cash Flows

Adjusting discount rates (the market discount rate approach) and incorporating market risk in cash flows (the market cash flow approach) are two ways to achieve the same answer. The following equation shows the mathematical relationship between the premium for market risk in the discount rate p and cash flows that incorporate market risk, f_t^m.

Value estimated by adjusting discount rates — Value estimated by adjusting cash flows

$$\frac{\overbrace{f_t^a}}{(1 + r_t + p)^t} = \frac{\overbrace{f_t^m}}{(1 + r_t)^t}$$

In this equation, the subscript t represents the number of periods in the future of the cash flow associated with the loan or guarantee, and r_t represents the Treasury rate used to discount cash flows at that point in the future. Average cash flows are expressed as f_t^a. The left side of the equation is the formula for the present value of the cash flow under the adjusted discount rate method; the right side shows the calculation based on f_t^m (the market cash flow method). On the left side, p represents the adjustment to the discount rate that will equate the left side with the right.

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[8] Cash flows that incorporate market risk go by many names in the technical literature: certainty-equivalent cash flows; risk-neutral cash flows; and risk-adjusted cash flows. The weights used to combine the set of possible cash flows at each point in the future into a summary statistic that incorporates market risk may be state prices, pricing kernels, stochastic discount factors, or risk-neutral probabilities. The common feature of those weights is to help develop estimates of cash flows that are grounded in the market pricing of financial assets. State prices are explicitly linked to the concept of marginal utility. Risk-neutral probabilities are not directly or explicitly tied to marginal utility; instead, they rely on no-arbitrage relationships with other financial assets. For an example of the use of risk-neutral probabilities to generate cash flows incorporating market risk, see Michael Falkenheim and George Pennacchi, "The Cost of Deposit Insurance for Privately Held Banks: A Market Comparable Approach," *Journal of Financial Services Research,* vol. 24, no. 2–3 (October 2003), pp. 121–148, https://tinyurl.com/264v638k. For an example of the use of state prices, see Deborah J. Lucas, "Measuring the Cost of Bailouts," *Annual Review of Financial Economics,* vol. 11 (December 2019), pp. 85–108, https://tinyurl.com/2jaemr2a; and Kenneth J. Arrow and Gerard Debreu, "Existence of an Equilibria for a Competitive Economy," *Econometrica,* vol. 22, no. 3 (July 1954), pp. 265–290, https://dx.doi.org/10.2307/1907353.

[9] See Congressional Budget Office, *Estimating the Value of Subsidies for Federal Loans and Loan Guarantees* (August 2004), www.cbo.gov/publication/15923.

Rearranging the formula and taking the log of each side leads to the following approximations,

$$p \approx \frac{\dot{f}_t^a - \dot{f}_t^m}{t}, \qquad \dot{f}_t^m \approx \dot{f}_t^a - tp,$$

where t is the number of periods in the future of the cash flow, $\dot{f}_t^a$ and $\dot{f}_t^{\dot{m}}$ are natural logs of f_t^a and f_t^m. If the average and market cash flows are known, then it is possible to calculate an adjustment to the discount rate that would be equivalent to market cash flows. Similarly, if the adjustment to the discount rate and average cash flows are known, then it is possible to calculate the equivalent market cash flows.

Discount Rates, Cash Flows, and the Difference Between the Fair-Value and FCRA Estimates

Discussions of fair value commonly use the market discount rate approach to describe fair value and compare it with FCRA value, perhaps because that approach is so commonly used to calculate fair value. However, the market cash flow approach is more useful than the market discount rate approach for illuminating how the fair-value and FCRA approaches differ. The main difference between fair-value estimates and FCRA estimates is how each addresses uncertainty. Uncertainty relates to cash flows at each point in time rather than to how cash flows are discounted over a period of time. The market discount rate approach, although useful as an estimation technique, blurs the distinction between time and uncertainty because market rates effectively contain two components: the first is the ratio of market cash flows to average cash flows, and the second component is a discount factor based on the risk-free interest rate. By separating the process into two steps, the market cash flow approach makes a clearer distinction between risk and the time value of money. That approach incorporates risk in the process by which the set of possible cash flows at a point in time is folded into a summary statistic. It incorporates only the time value of money in the discount rate.

It is possible to incorporate market risk in costs without using present value. FCRA applies present value without incorporating market risk, changing the timing of when costs are recognized (see Table 1).

Table 1.

How Present Value and Market Risk Are Measured in Different Federal Cost Estimates

		Does Cost Estimate Include Market Risk?	
		No	Yes
Is Cost Measure on the Basis of Net Present Value?	No	Cash budgeting for most government activities	Projection of investments in the National Railroad Retirement Investment Trust
	Yes	Credit programs	Fair-value budgeting (Fannie Mae, Freddie Mac, Troubled Asset Relief Program, and U.S. obligations to the International Monetary Fund)

Data source: Congressional Budget Office.

Under FCRA, agencies project the future cash flows of loans and loan guarantees as the average of their possible values, weighting different outcomes by their probability. Fair-value budgeting measures the costs of loans and loan guarantees with weights that are consistent with pricing in financial markets.

FCRA = Federal Credit Reform Act of 1990.

For most activities, the federal budget projects average cash flows when transactions take place and does not discount those cash flows. Under FCRA, average cash flows are discounted to the time the commitment is made using projected rates for Treasury securities; the timing of when costs are recognized changes, but their effect on the debt does not. For other activities, the federal budget incorporates market risk, usually but not always in combination with present value. For example, the budget incorporates market risk in cash flow estimates made by the National Railroad Retirement Investment Trust (NRRIT), which is partly invested in stocks and bonds. If CBO projected the returns that stocks and bonds earn on average, it would show the NRRIT earning a higher return than the interest rate on Treasury securities. However, under economic theory the market return on any asset is the same as the rate on Treasury securities because the difference between the average return on risky assets and the interest rate on Treasury securities is equal to the cost of additional risk. Fair-value estimates incorporate the cost of market risk in present-value estimates for programs such as those of Fannie Mae and Freddie Mac and the Troubled Asset Relief Program, as well as activities such as U.S. participation in the International Monetary Fund.

How the Fair-Value Approach Incorporates More Information in Single-Point Estimates Than the FCRA Approach

Both the FCRA and fair-value approaches generate a single-point estimate that in most cases differs from the cost of a loan or loan guarantee program after the fact, when all the uncertainty is resolved. Both FCRA and fair-value estimates are calculated at the point when the loans are made. They present values for a sequence of summary statistics representing many possible

values for cash flows from the loans at each point in the future. Actual cash flows will almost surely differ from any program's estimates because the future cash flows of credit programs are uncertain and depend on the path of the economy. Moreover, that uncertainty persists even if estimates for different programs and periods are added together. The error in one program correlates with errors in estimates made for different programs in the same year because loan performance is related to the overall economy. All credit programs tend to perform well or poorly as a function of the economy's performance.

Fair values represent the set of possible cash flows at each point in the future with a different summary statistic than FCRA. Whereas FCRA weights different scenarios for cash flows by their probability of occurring, the fair-value approach weights those scenarios on the basis of their effect on market prices. They incorporate the state of the economy in each scenario in addition to the probability that the scenario will occur.

In the example, the cash outflows of a government credit program differ between scenarios in which the economy is strong and those in which it underperforms (see Table 2). Scenarios in which the economy underperforms have a one-in-four probability of occurring but the weight used in pricing them is higher, reflecting the fact that households are generally less well-off when the economy is weak than when it is strong. That occurs because households are less able to afford losses on any individual investment in a weak economy; as a result, they give greater weight to losses when the economy is weak than they do to similarly sized gains when the economy is strong.

Table 2.

How Economic Scenarios are Weighted in Cost Estimates for Federal Loan Programs

Scenario	Cash Outflow (Cost)	Probability Weight (Used in statistical average)	Average Cash Flow (FCRA Estimates)	Weight Used in Pricing	Market Cash Flow (Fair-value estimates)
Economy Is Good	0	¾	9	2/3	12
Economy Is Poor	36	¼		1/3	

Data source: Congressional Budget Office.

Under FCRA, agencies project the future cash flows of loans and loan guarantees as the average of their possible values, weighting different outcomes by their probability. Fair-value budgeting measures the costs of loans and loan guarantees with weights that are consistent with pricing in financial markets.

FCRA = Federal Credit Reform Act of 1990.

The example highlights the fact that the fair-value approach and the FCRA approach weight the same cash flows in different ways. Fair value is a weighted average of the cash flows that is consistent with pricing in financial markets. The FCRA approach weights those cash flows using probabilities.

The fair-value approach incorporates more information than the FCRA approach by capturing market risk in projected cash flows. FCRA estimates consider the probability that each possible scenario will occur. Fair-value estimates consider additional information: the importance of those scenarios to investors as revealed in the prices that they pay for financial assets and obligations. The FCRA approach weights scenarios by probability in a summary statistic that combines the set of possible future cash flows in a single number. But probability alone does not reflect the weight investors place on a scenario. Investors value some scenarios more highly than others regardless of their probability in decisions affecting those investors' private wealth and welfare.