
CapInvest

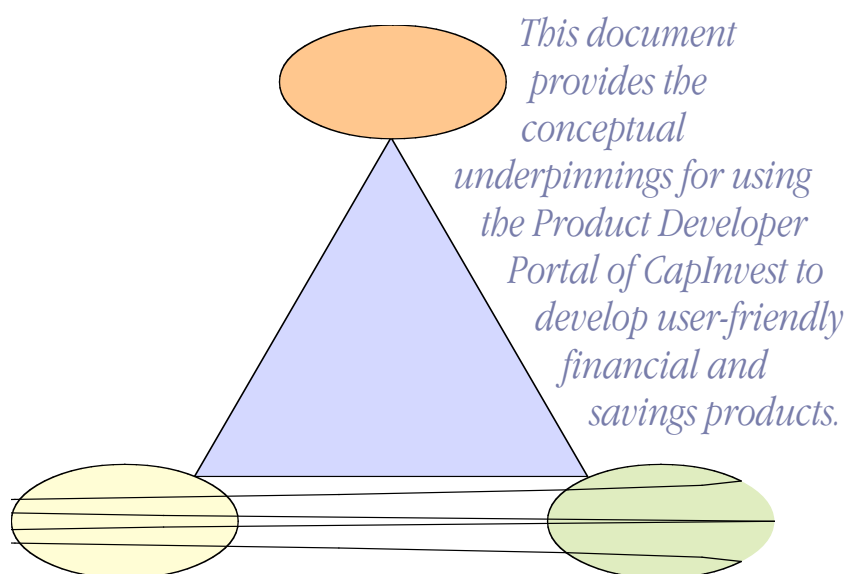


*Developing Financial and
Savings Products*

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Introduction



Additionally, the document sets out a step-by-step exercise for creating a savings product and the calculations to verify the mathematical accuracy of the product.

Discounted Cash Flow (DCF) concepts are used extensively in CapInvest and in the Product Developer Portal. Accordingly, the last page of this document sets out discounted cash flow equations. While DCF is integrated very tightly into CapInvest, a user only needs to interpret results arising from use of DCF.

<p><i>Types of Products</i></p>	<p>Products that you develop with CapInvest can be classified into two categories:</p> <p>(a) Savings products; (b) Financial products</p> <p>Hybrid products combine (a) and (b) in innovative ways.</p> <p>Savings products are designed to attract savings to financial institutions such as banks, finance companies, leasing and hire purchase companies and companies raising funds from the general public via fixed deposit schemes. Common types of savings products are Savings Accounts, Insurance Contracts and Fixed Deposits.</p> <p>Financial products enable an institution to deploy resources into financial assets. Common examples of financial products are: personal loans, vehicle finance, housing finance, leases, hire purchases, and so on.</p> <p>A financial institution needs to compete on both fronts to stay profitable.</p>
<p><i>Risk Differentiates the two Products</i></p>	<p>The difference between the two products is risk - a savings product does not impose risk on a financial institution – a customer provides resources to an institution for specified end objectives, for example, to receive periodic income, to meet future expenses, to receive a monthly pension, and so on. The business risk of the transaction is entirely with the customer since it is his decision if an institution represents acceptable risk. Thus, primary funding for Savings Products is sourced entirely from customers.</p> <p>A financial product, on the other hand, imposes business risk on a financial institution - an institution is required not only to develop attractive products but also to take the additional step of ensuring that products are offered to those representing acceptable credit risk. An institution, either from own resources or from borrowings, contributes the funding for financial products.</p>
<p><i>Product Flows</i></p>	<p>From a financial institution viewpoint, a 'Savings' Product is characterized by (a) inflows from customer; (b) outflows to customer. This order is reversed in a Financial Product: (a) outflows to customer; (b) inflows from customer.</p>

<i>Rates for Pricing</i>	<p>The pricing rate for 'Savings' Products is an institution's borrowing (savings) rate for that category of borrowings; the pricing rate for 'Financial' Products is an institution's lending rate, adjusted for that category of lending (credit risk).</p>
<i>Product Constrains</i>	<p>The constrain in creating a 'Savings' product is that outflows to a customer can only occur after inflows have occurred. Thus, a savings product that provides annual income for 10 years would require a customer to first provide savings to an institution to support product outflows.</p> <p>A financial product is more dynamic - and comes with business risk – outflow to the customer occurs first and inflows come later: from earnings and other sources of income.</p>
<i>Capitalized Value of a Product</i>	<p>Contrary to popular practice, a financial institution's investment(s) in a financial product need not coincide with the start date of the transaction. Investment(s) can take place before or after the start date of the transaction.</p> <p>For example, Investments before the start date include, deposits placed by an institution with capital goods suppliers, contractors. Investments after start date could include, annual insurance premium on a financed asset that is paid by a financier but charged to customer.</p> <p>A housing finance company could offer a product that provides resources for the following items (for example):</p> <ul style="list-style-type: none"> (a) for buying a house in Year 0; (b) for 10 annual property tax payments in Years 1 -10, (c) for purchase of furniture in year 2 (d) for estimated repair work in year 5, and so on. <p>An institution may require a repayment schedule for a transaction to conform to specified dates, disregarding the date of disbursement of funds – for example, repayment dates could be April 15, July 15, October 15, and January 15. Financing transactions need to synchronize with these repayment dates.</p>

Thus, an institution may face the need to capture several investment items in a transaction, regardless of the point of time of occurrence with a view to developing a user-friendly product that offers a single repayment schedule while addressing Return on Investment objectives of an institution.

Capturing all investment flows in a single 'Capitalized Value' item enables an institution to develop a range of products that are dictated not by institutional procedures but by customer requirements.

CI enables a user to create such products very easily using the 'Product Developer' portal by listing Investment items in a transaction, the investment dates, the pricing rate(s), the transaction start date, and so on. Different rates for the Pre Start Phase (lending rate) and the Post Start Phase (borrowing/savings rate) are used to compute a single Capitalized Value of the transaction, which is priced to the customer using institutional pricing parameters.

Recurring and Non-Recurring Investments in a Transaction

Investments in a transaction can be of two types:

(a) Recurring Investments – for example, Property Tax payments payable each year for 10 years, Annual Insurance Premium. 'Recurring' investment items are established by setting the number of repeats (for example, 10 annual property tax payments), the date of first investment, the amount of investment, and so on – a total of 15 recurring investments for a transaction can be established in CI (with unlimited repeats for each item);

(b) Non-Recurring Investments – these are one time investments occurring on customer specified dates; there could be several non-recurring investments in a transaction at different periods of time – a total of 15 non-recurring investments in a transaction can be established in CI.

<p><i>Capitalizing a Recurring Investment in a Transaction</i></p>	<p>The Capitalized Value of an Item that is a recurring item is computed in two stages: (a) first, future payments are brought back to the first payment date by discounting future flows (non-first period flows) using the 'savings' rate of an institution – this is represented by DCF1; (b) DCF1 is discounted to start date of a transaction, to arrive at DCF2, which is the capitalized value of this recurring item.</p>
	<p>For example, assume the start date of the transaction is January 1, 2004. Customer requires 10 annual payments of 25,000 starting July 1, 2004. In the first instance, the present value of 25,000 for 10 years is computed by discounting these flows to arrive at DCF1 on July 1, 2004. If the savings rate is 4%, DCF1 would be 210,256.78; however, since the start date of the transaction is January 1, 2004, DCF1 needs to be discounted again to arrive at the capitalized value on that date. Using the savings rate of 4%, DCF 2 (or the capitalized value of this item) on January 1, 2004 is found to be 206,100.27. If the institution wishes to price this transaction over a 5-year period using a lending rate of 10%, monthly repayment at end of each month would be 4,342.83.</p>
	<p>Non-recurring investments are compounded / discounted with reference to the start date of a transaction using either the 'lending' rate or the 'savings' rate based on whether the investment occurs before or after the start date of the transaction.</p> <p>If an investment takes place before the start date of a transaction, the item is compounded using an institution's lending rate. For example, assume the transaction start date is January 1, 2004 and that an investment of 25,000 is made in a transaction on October 1, 2003. Assuming lending rate of 10%, the capitalized value of the transaction on January 1, 2004 would be 25,630.22. If the item was invested after the start date of the transaction, on April 1, 2004, and if we assume the savings rate is 6%, the capitalized value of the item on January 1, 2004 would be 24,628.72 (monthly discounting).</p>

Compounding Periods

Five Compounding frequencies are available for Pre-Start and Post-Start Investments which can be set independently of each other: daily, monthly, quarterly, half-yearly, and yearly. The default compounding period is Monthly for both Pre-Start and Post-Start investments.

When the compounding frequency is different from the payment frequency, CI computes an equivalent rate for use – for example, assume a recurring item is paid quarterly and the user-specified compounding frequency is daily. Equivalency is computed as follows: (a) first, the nominal annual rate is transformed into an effective rate using daily compounding; (b) the effective rate that is calculated using daily compounding is reconverted to an annual rate using quarterly compounding. This annual rate is divided by 4 to arrive at an equivalent quarterly compounding rate and is the rate used by CI in arriving at capitalized value.

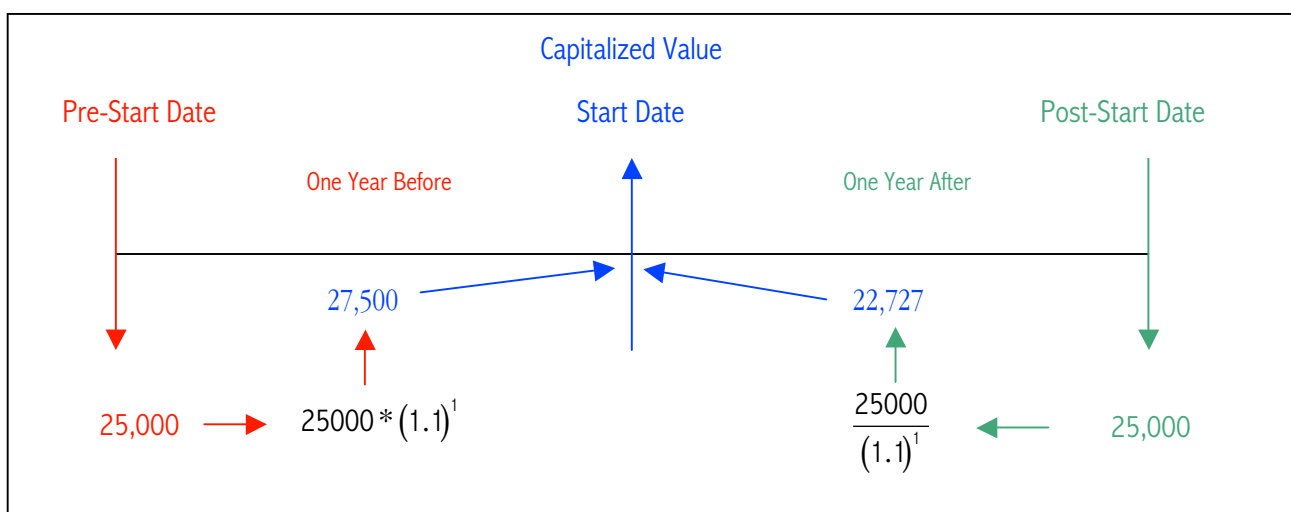
Thus, in developing a Financial Product, the use of two pricing rates maybe necessary to compute the capitalized value of a transaction: (a) for investment items prior to the Start date of a transaction – lending rate of an institution will need to be used; (b) for investment items after the start date – the borrowing (or savings) rate will need to be used. After the capitalized value of a financial product is computed by the Portal, the same can be transferred to the Loan / Principal Value Cell in the main module by clicking the 'Transfer' button. Once the capitalized value is in the module, the transaction can be developed further, for example, by calculating customer repayments given the institution's lending rate.

In developing a Savings Product, an institution's borrowing (savings) rate is used in computing the capitalized value of the transaction - this is transferred to the 'Future Value' cell in the module; once inside the module, the periodic payment needed to support the future outflows can be calculated, just like any other transaction.

If there is a situation where a recurring investment item in a transaction straddles both the pre-start and post-start phases, the item will need to be split into Pre-Start and Post-Start components; these components will need to be entered separately - this is required since different pricing rates will apply to the two components.

The Relationship between the Start Date of a Transaction and (a) Pre-Start Date and (b) Post-Start Date, given a rate of 10% is set out below: as you can note, Pre-Start date investments (25,000) are 'compounded' using the Lending Rate to arrive at the capitalized value on the start date (27,500) while Post-Start date investments (25,000) are 'discounted' using the Borrowings / Savings Rate to arrive at the capitalized value on the start date (22,727). Note the compounding and discounting formulas.

The Relationship Between Pre-Start Date and Post-Start Date Investments



Regardless of the product being developed, CI provides a core set of analytical tools for creating both types of Products.

Assume a customer has the following income requirements:

<i>Transaction Start Date</i>	January 1, 2004
<i>Non-Recurring Items</i>	100,000 to meet marriage expenses – required on March 14, 2024
<i>Recurring Items</i>	25,000 at beginning of each year for 4 years to meet daughter's college expenses, starting January 1, 2016
	50,000 at beginning of each year for 10 years to supplement pension income, starting October 10, 2026

Given the above requirements, customer wishes to make monthly deposits at the beginning of each month into a savings account for 12 years at the annual savings rate of 6%. How much should he be required to deposit each month? As you will note, the answer is 1,686.61.

The first step is to compute the Capitalized Value of the transaction by discounting the future income requirements of the customer using the annual savings rate of 6% (which translates to a monthly rate of 0.5%). We need to select a date on which to arrive at the capitalized value of outflows to customer. We may select January 1, 2016 since the first outflow to customer occurs on that date.

CAPITALIZED VALUE / NON-RECURRING ITEM ON JANUARY 1, 2016

Date	Item	Monthly Rate	Discounting Formula	Discounted Value
Mar 14, 2024	100,000	0.5%	$=100,000/(1.005)^{98.43*}$	61,205.06
Discounted Value / January 1, 2016				61,205.06

* Number of days between Mar 14, 2024 and January 1, 2016 is 2953 days which is equal to $2953/30 = 98.43$ Months. The interest rate per month is $6\%/12$ or 0.005%

CAPITALIZED VALUE / RECURRING ITEM (1) ON JANUARY 1, 2016

Year	Item	Monthly Rate	Discounting Formula	Discounted Value
Jan 1, 2016	25,000	0.5%	$=25,000/(1.005)^0$	25,000.00
Jan 1, 2017	25,000	0.5%	$=25,000/(1.005)^{12}$	23,547.63
Jan 1, 2018	25,000	0.5%	$=25,000/(1.005)^{24}$	22,179.64
Jan 1, 2019	25,000	0.5%	$=25,000/(1.005)^{36}$	20,891.12
Discounted Value / January 1, 2016				91,618.40

CAPITALIZED VALUE / RECURRING ITEM (2) ON JANUARY 1, 2016

Year	Item	Monthly Rate	Discounting Formula	Discounted Value
Oct 10, 2026	50,000	0.5%	$=50,000/(1.005)^0$	50,000.00
Oct 10, 2027	50,000	0.5%	$=50,000/(1.005)^{12}$	47,095.27
Oct 10, 2028	50,000	0.5%	$=50,000/(1.005)^{24}$	44,359.28
Oct 10, 2029	50,000	0.5%	$=50,000/(1.005)^{36}$	41,782.25
Oct 10, 2030	50,000	0.5%	$=50,000/(1.005)^{48}$	39,354.92
Oct 10, 2031	50,000	0.5%	$=50,000/(1.005)^{60}$	37,068.61
Oct 10, 2032	50,000	0.5%	$=50,000/(1.005)^{72}$	34,915.12
Oct 10, 2033	50,000	0.5%	$=50,000/(1.005)^{84}$	32,886.74
Oct 10, 2034	50,000	0.5%	$=50,000/(1.005)^{96}$	30,976.20
Oct 10, 2035	50,000	0.5%	$=50,000/(1.005)^{108}$	29,176.64
Discounted Value / October 10, 2026				387,615.03
Oct 10, 2026	387,615.03	0.5%	$=387,615.03/(1.005)^{129.3*}$	
Discounted Value / January 1, 2016 / Recurring Item 2				203,389.64

* Number of days between October 10, 2026 and January 1, 2016 is 3879 days, which is equal to 3879/30 months or 129.3 Months. The interest rate per month is 6%/12 or 0.5%

CAPITALIZED VALUE OF TRANSACTION ON JANUARY 1, 2016

Non-Recurring Item	61,205.06
Recurring Item (1)	91,618.40
Recurring Item (2)	203,389.64
Total Capitalized Value	356,213.09

Transferring the capitalized value of 356,213.10 to the module and setting repayment period to 12 years (difference between Transaction Start Date of January 1, 2004 and January 1, 2016) and annual rate to 6%, the monthly payment, payable at the beginning of each month is computed by CI as being 1,686.61 – this is the amount the customer would need to deposit each month into his Savings Account.

The 'Transfer' button in the Portal transports the capitalized cost to the appropriate cell in the module on the basis of type of product (to future value cell since this is a Savings Product).

Transaction Wrap-Up

<i>Transaction Start Date</i>	January 1, 2004
<i>Monthly Deposit into Savings Account (beginning of month) for 12 years (144 months)</i>	1,686.61
<i>Savings Rate</i>	6% Annual Monthly - 0.5%
<i>Balance in Account after 12 years (January 1, 2016)</i>	$A \times (1 + i) \times \left\{ \frac{(1 + i)^n - 1}{i} \right\}$ <p>where A is the monthly deposit and i is the monthly rate</p> $1686.61 * (1.005) * \left\{ \frac{(1.005)^{144} - 1}{.005} \right\}$ $= 356,213.09$

Calculations

Recurring Item (1) / 25,000

Op Balance / Jan 1, 2016	356,213.09	—————	Note the opening balance in Savings Account after monthly deposits for 12 years
Withdrawal	-25,000.00		
CI Bal	331,213.09		
Op Balance / Jan 1, 2017	351,641.59	—————	Closing Balance of Previous Period plus accruals for the year
Withdrawal	-25,000.00		
CI Bal	326,641.59		
Op Balance / Jan 1, 2018	346,788.13	—————	Note the annual withdrawals
Withdrawal	-25,000.00		
CI Bal	321,788.13		
Op Balance / Jan 1, 2019	341,635.32	—————	Closing Balance after meeting annual withdrawals of customer
Withdrawal	-25,000.00		
CI Bal	316,635.32		

Non-Recurring Item / 100,000

Note the number of days between the withdrawal date of this item and the closing date of the previous item.

This information is necessary to update the account with the necessary accruals

Start Date	1-Jan-2019
End Date	14-Mar-2024

Days	1873
Months	62.43

Note the new Opening Balance after meeting accruals in intervening period of 62.43 months

Op Balance / 3-14-2024	432,308.54
Withdrawal	-100,000.00
CI Bal	332,308.54

Note the withdrawal of the non-recurring item and the closing balance on that date

Recurring Item (2) / 50,000

Start Date	14-Mar-2024
End Date	10-Oct-2026
Days	926
Months	30.87
Op Balance / 10-10-2026	387,615.03
Withdrawal	-50,000.00
CI Bal	337,615.03
Op Balance / 10-10-2027	358,438.38
Withdrawal	-50,000.00
CI Bal	308,438.38
Op Balance / 10-10-2028	327,462.19
Withdrawal	-50,000.00
CI Bal	277,462.19
Op Balance / 10-10-2029	294,575.45
Withdrawal	-50,000.00
CI Bal	244,575.45
Op Balance / 10-10-2030	259,660.33
Withdrawal	-50,000.00
CI Bal	209,660.33
Op Balance / 10-10-2031	222,591.72
Withdrawal	-50,000.00
CI Bal	172,591.72
Op Balance / 10-10-2032	183,236.80
Withdrawal	-50,000.00
CI Bal	133,236.80
Op Balance / 10-10-2033	141,454.55
Withdrawal	-50,000.00
CI Bal	91,454.55
Op Balance / 10-10-2034	97,095.27
Withdrawal	-50,000.00
CI Bal	47,095.27
Op Balance / 10-10-2035	50,000.00
Withdrawal	-50,000.00
CI Bal	0.00

Calculations

All these calculations relate to the recurring item (2) of 50,000. Opening balance of a period is calculated using closing balance of a previous period and adding accruals of 0.5% per month.

Note the zero balance in account after meeting all withdrawals –account is fully squared up.

CapInvest / Discounted Cash Flow Equations

EQUATION	IN ARREARS	IN ADVANCE
Sum of Annuity	$A \times \left\{ \frac{(1+i)^n - 1}{i} \right\}$	$A \times (1+i) \times \left\{ \frac{(1+i)^n - 1}{i} \right\}$
Annuity (given Sum)	$Sum \times \left\{ \frac{i}{(1+i)^n - 1} \right\}$	$Sum \times \frac{1}{(1+i)} \times \left\{ \frac{i}{(1+i)^n - 1} \right\}$
PV of Annuity	$A \times \left\{ \frac{1 - (1+i)^{-n}}{i} \right\}$	$A \times (1+i) \times \left\{ \frac{1 - (1+i)^{-n}}{i} \right\}$
Annuity (given PV)	$PV \times \left\{ \frac{i}{1 - (1+i)^{-n}} \right\}$	$PV \times \frac{1}{(1+i)} \times \left\{ \frac{i}{1 - (1+i)^{-n}} \right\}$
Future Value (Annual Compounding)	$PV \times \{1+i\}^n$	
Future Value (Compounded more than once in a year)	$PV \times \left\{ 1 + \frac{i}{j} \right\}^{j \times n}$	
Present Value (Annual Compounding)	$FV \times \frac{1}{\{1+i\}^n}$	
Present Value (Compounded more than once in a year)	$FV \times \frac{1}{\left\{ 1 + \frac{i}{j} \right\}^{j \times n}}$	
NPV	$CF_0 + \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \dots + \frac{CF_n}{(1+i)^n}$ $\sum_{t=0}^n \frac{CF_t}{(1+i)^t}$	
IRR	$CF_0 + \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \dots + \frac{CF_n}{(1+i)^n} = 0$ $\sum_{t=0}^n \frac{CF_t}{(1+i)^t} = 0$	