# CAPITAL BUDGETING
AND BUSINESS CYCLES

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Every investment project is aimed at achieving some future goal. This goal can only be attained by employing scarce resources, like time. Every investment project entails foregoing other investment projects. It is impossible to undertake all investment projects simultaneously because resources are scarce. This means each investment project is subject to cost. The investment project may be unsuccessful in achieving the future goal and the entrepreneur may suffer a loss. On the other hand, investment projects are only undertaken because they are perceived as more valuable than their costs. Every investment project undertaken implies the possibility of earning a profit.

Investment projects take time. An investment project can be represented by a time line. Time *A* represents the beginning of the production process. Time *B* is the end of the production process. Line *AB* is called the *period of production*.

<div align="center">FIGURE 1</div>
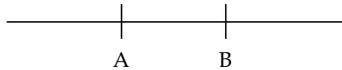
Present goods are scarce resources that can be consumed immediately. On the other hand, future goods cannot be consumed immediately. Future goods are only expected to be consumer goods at some point in the future. An investment project entails making an investment at time A and receiving a present good at time B.

All else equal, present goods are more valuable than future goods.[1] Any good at time *A* is more valuable than the same good at time *B*. This is called time preference. Money is the present good par excellence. Therefore, future goods can be called future

cash flows. All else equal, present money is more valuable than future money. This is called the time value of money.

The interest rate is the price of present goods in terms of future goods. The interest rate is the price which equates the amount of present goods provided by savers with the amount of present goods demanded by investors. Like all prices, the interest rate is determined by supply and demand. Savers are suppliers of present goods. The supply curve (S) is the quantity of present goods supplied at each interest rate. Factor owners (investors) are the demanders, or buyers, of present goods. The demand curve (D) is the quantity of present goods demanded at each interest rate. The intersection of the supply and demand curve determines the interest rate. The interest rate is determined by the supply and demand for present goods:[2]

FIGURE 2
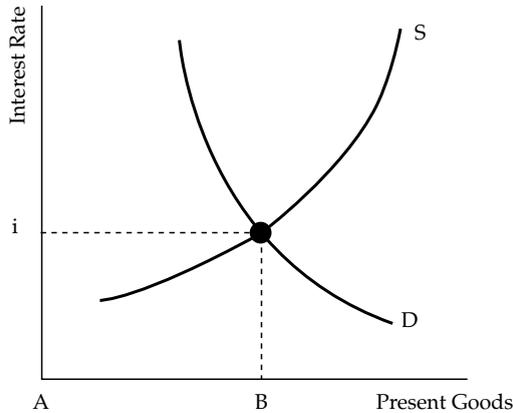
Changes in the supply and demand for present goods result in changes in the interest rate. An increase in savings constitutes an increase in the supply of present goods. An increase in the supply of present goods means the supply curve shifts right, from S to S′. The interest rate falls from i to i′ (Figure 3).

The lower interest rate after an increase in the supply of savings is a key market signal. It tells entrepreneurs that consumption has fallen and savings has increased. It indicates consumers desire

FIGURE 3
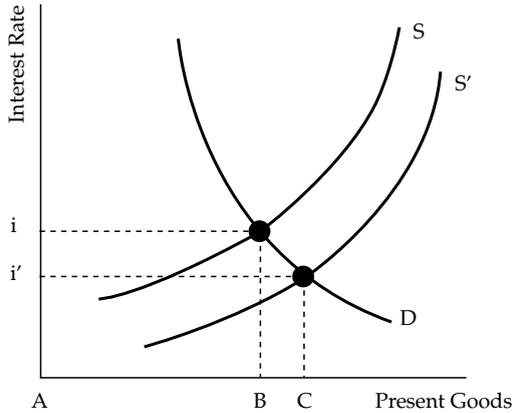
relatively more future goods and fewer present goods. This message is transmitted via the entrepreneur's capital budgeting techniques.

Entrepreneurs strive to buy factors at a low price and sell them at a high price. Entrepreneurs do this by allocating factors where they are undervalued compared to consumer desires. Entrepreneurs resort to economic calculation to determine which factors are undervalued compared to consumer desires. In other words, entrepreneurs use economic calculation to decide between alternative investment projects. Entrepreneurs decide between alternative investment projects by comparing forecasted cash flows. The aspect of economic calculation dealing with the future is called capital budgeting.[3] Capital budgeting is the entrepreneurial function which coordinates the actions of entrepreneurs with the demands of the consumers.

In capital budgeting, the entrepreneur doesn't know the precise time and size the future cash flows. Forecasting the size and timing of an investment project's future cash flows becomes a key entrepreneurial function. Entrepreneurs use time lines in economic calculation because many projects throw off multiple cash flows at various points in the future. For example, suppose an entrepreneur wants to buy a new machine for 200. He forecasts the new machine will yield cash flows of 100 per year for 5 years, with a 200 initial investment.

FIGURE 4
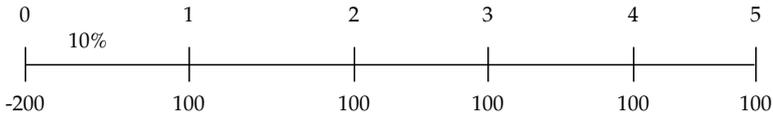
However, the value of each future cash flow is not 100 because of the time value of money. Entrepreneurs discount future cash flows to find the present capital value. Suppose the interest rate is 10%. In the example above the capital value (present value) is 374.12. The entrepreneur subtracts his initial 200 investment from the present value to find the Net Present Value (NPV).[4]

TABLE 1

PRESENT VALUE AT 10% INTEREST RATE

Time	Cash Flow	Present Value
1	100	90.48
2	100	81.87
3	100	74.08
4	100	67.03
5	100	60.65
Present value		**374.12**
Net Present Value		**174.12**

All else equal, the PV increases as interest rates fall. This occurs because the forecasted cash flows are discounted at a lower rate. For example, suppose the entrepreneur had only required a 5% rate of return. Notice the PV increases at the lower interest rate (Table 2).

All else equal, the present value of an investment project increases as interest rates fall. More generally, the relationship between the present value and the interest rate can be illustrated with a simple diagram (Figure 5).

Suppose there is an increase in the supply of present goods and the interest rate falls. All else equal, this change in the interest

TABLE 2

PRESENT VALUE AT 5% INTEREST RATE

| Time	Cash Flow	Present Value
1	100	95.12
2	100	90.48
3	100	86.07
4	100	81.87
5	100	77.88
Present value		**431.43**
Net Present Value		**231.43**

FIGURE 5
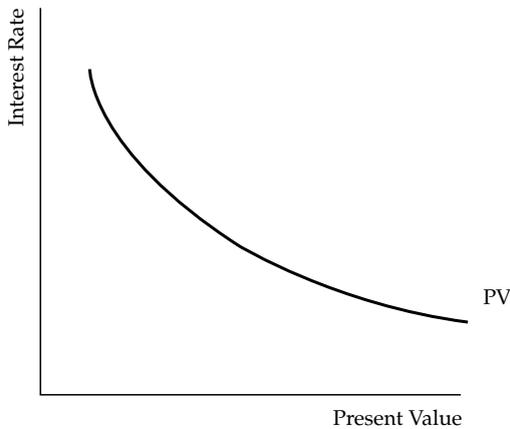
rate will cause the PV of investment projects to rise. Again, the PV increases because the future cash flows are discounted at a lower rate. This is represented by a move down the PV Curve from PV to PV' (Figure 6).

The increase in savings means there has been a fall in consumption. These unconsumed resources are freed up for investment purposes. The increase in present values encourages entrepreneurs to undertake more projects. Projects that were not profitable at the higher interest rate are now profitable.

FIGURE 6
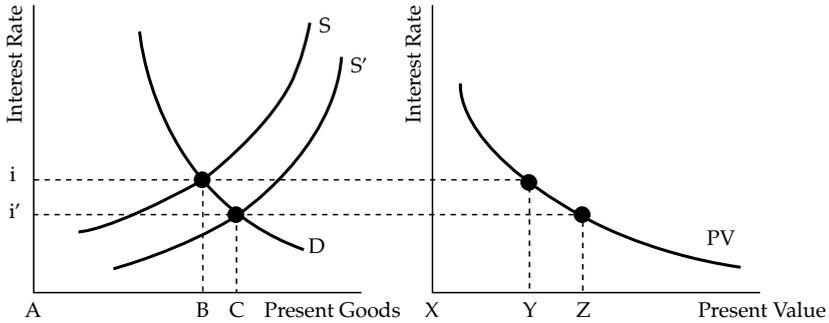
A fall in the interest rate also encourages entrepreneurs to take on different types of projects. More specifically, the first projects undertaken are always the shortest and most productive projects available. So any increase in savings must lead to investment in longer and more productive investment projects. Longer production processes make it possible to produce more output with the same input. Longer production processes also make it possible to produce products that couldn't be produced. This can be explained using a capital budgeting technique called duration.[5]

Duration is the weighted average time the entrepreneur must wait to receive present goods from his investment project. Duration is the weighted average lifetime of a set of future cash payments.[6] It is the weighted average of the maturities of future cash flows. Since an investment project is a set of future cash flows, duration can also be called the weighted average life of an investment project. Project duration is the effective maturity of an investment project.[7] In short, project duration is the effective period of production (Figure 7).

The duration of an annuity style investment project is defined by the following expression.[8] The duration of an annuity style project is a function of the project term and interest rate:

$$D = \frac{e^i(e^{it} - 1) + t(1 - e^i)}{(e^i - 1)(e^{it} - 1)}$$

FIGURE 7
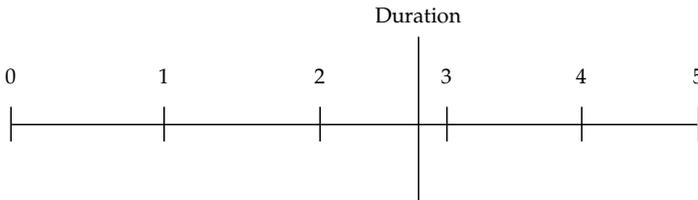
Duration

Where:

D = Duration of an annuity
t = Project years
i = interest rate

Duration is used in capital budgeting as a measure of interest rate sensitivity.[9] The following formula shows how the present value changes given a change in interest rates:[10]

$$\%\Delta PV = -D * \Delta i$$

Where:

$\%\Delta PV$ = percentage change in present value
D = Duration
i = interest rate

All else equal, duration increases as the interest rate falls.[11] This relationship can be illustrated[12] using the two projects above. Recall the interest rate in the first example was 10%. At this rate, the project's duration is 2.80[13] (Table 3).

Duration indicates the effective end of the period of production for an investment project. A time line can be used to evaluate duration. In this example, time 0 is the beginning of the investment project. Time 2.8 is the investment project's effective period of production (Figure 8).

Now suppose the interest rate falls to 5%. At the new lower rate of 5%, the project's duration increases to 2.9[14] (Table 4).

TABLE 3
DURATION AT 10% INTEREST RATE

Time	Cash Flow	Present Value	Weight	Weighted Life
1	100	90.48	24.19%	0.24
2	100	81.87	21.88%	0.44
3	100	74.08	19.80%	0.59
4	100	67.03	17.92%	0.72
5	100	60.65	16.21%	0.81
Total	500	374.12	100.00%	**2,80**

FIGURE 8

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0                              2,8                5
├──────────────────────────────┼────────────────┤
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TABLE 4
DURATION AT 5% INTEREST RATE

| Time	Cash Flow	Present Value	Weight	Weighted Life
1	100	95.12	22.05%	0.22
2	100	90.48	20.97%	0.42
3	100	86.07	19.95%	0.60
4	100	81.87	18.98%	0.76
5	100	77.88	18.05%	0.90
Total	500	431.43	100.00%	**2,90**

The effective period of production increases to 2.9 at a 5% interest rate, as shown on the following time line:

FIGURE 9

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0                                 2,9              5
├─────────────────────────────────┼──────────────┤
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This example demonstrates that duration is inversely related to the interest rate: other things equal, duration increases as the interest rate decreases. The relationship between interest rates and duration can be expressed with the following diagram. The shape of the duration curve is defined by the expression D above. The duration curve slopes downward to the right, and becomes more elastic at lower interest rates:

FIGURE 10
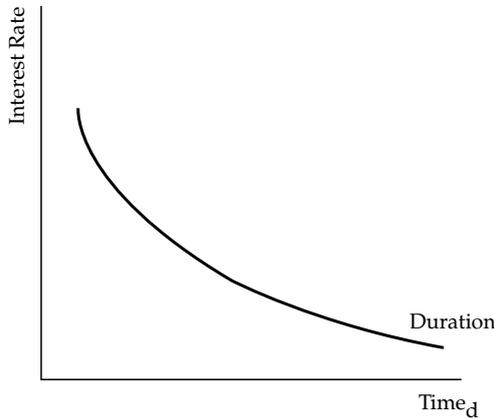
The duration diagram shows the effective period of production for an annuity style investment project at different interest rates. $Time_d$ is the x-axis. The x-axis is in fact a time line, like the time lines above (Figure 11).

The duration diagram curve shows the duration of an investment project at different interest rates. In other words, the curve indicates the effective period of production for an investment project at each interest rate. For instance, the effective period of production at i is line AB. The effective period of production at the lower interest rate i' is line AC (Figure 12).

Duration has an additive property,[15] so it's possible to combine the duration diagram with the aggregate time market diagram (Figure 13).

An increase in savings causes the supply curve of present goods curve to shift right to S'. The interest rate falls from i to i'.
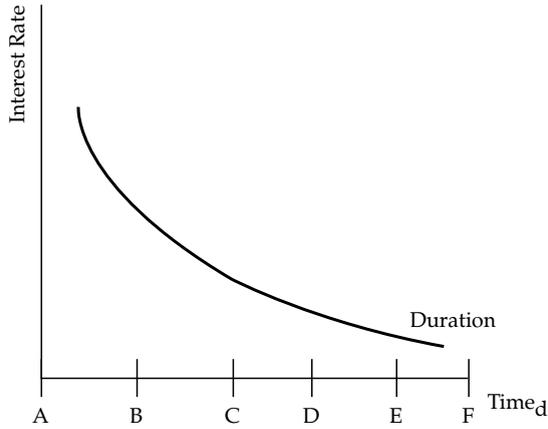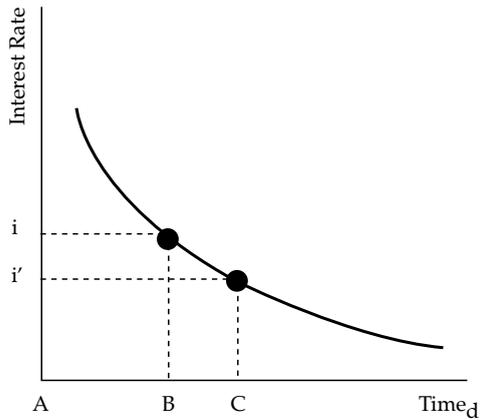
FIGURE 11

FIGURE 12

Duration increases, as represented by a move down the Duration curve from D to D′. In short, an increase in savings will lead to an increase in the effective period of production of society's investment projects[16] (Figure 14).

The present goods provided by savers increases from line AB to AC. Entrepreneurs accordingly increase project durations from time XY to XZ. Entrepreneurs allocate factors where they are
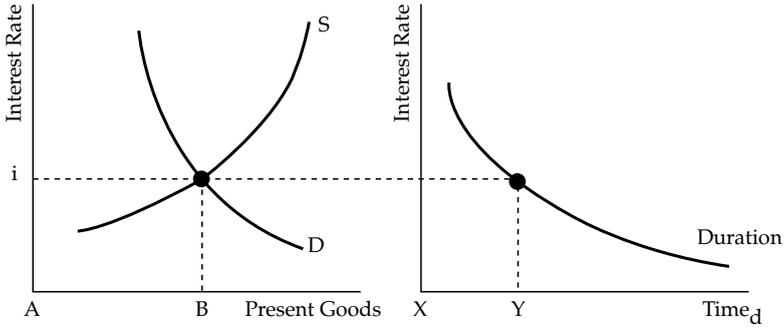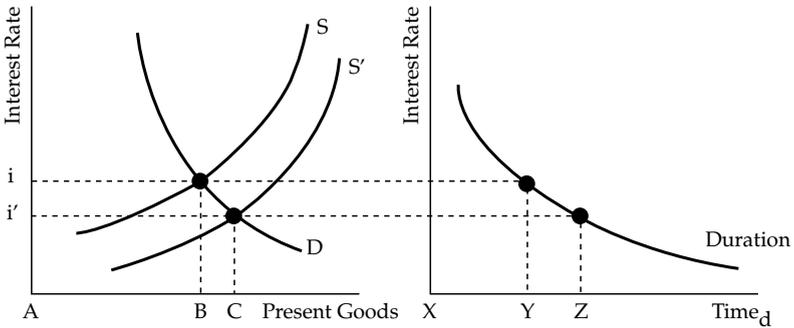
FIGURE 13

FIGURE 14

undervalued compared to consumer desires. When interest rates are low, capital budgeting techniques indicate to entrepreneurs that factors with longer durations are undervalued compared to consumer desires. Entrepreneurs are incentivized to take on longer duration projects at lower interest rates.[17] An increase in savings will lead to a reduction in the demand for factors early on the time line and increase in the demand for factors late on the time line.[18]

This phenomenon is explained by examining the duration computations. The weights accorded to each cash flow are influenced by the interest rate. Each cash flow's weight is the present value of the cash flow divided by the total present value of the project. The first cash flow has a weighting of 24.19% at a 10% interest rate. The fifth cash flow has a weight of 16.21% (Figure 15).

FIGURE 15
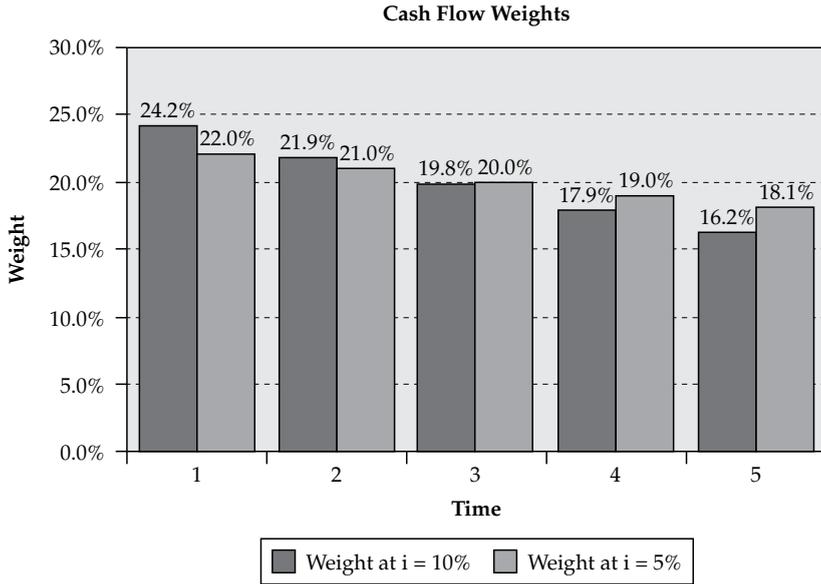
Cash Flow Weights

In contrast, the weight of the first cash flow falls when the interest rate drops to 5%. The weight of the first cash flow falls from 24.19% to 22.05%. The weight of the fifth cash flow increases from 16.21% to 18.05%. The early weights fall and late weights rise as interest rates fall because distant cash flows are more interest rate sensitive than early cash flows. This can be demonstrated by examining the present value of each cash flow at the two rates (Figure 16).

Distant cash flows become relatively more important when interest rates are low. The present value of the first cash flow increases by approximately 5% when interest rates fall from 10% to 5%. However, the present value of the fifth cash flow increases by approximately 25%. Therefore, the present value of the fifth cash flow becomes a larger percentage of the entire projects present value.

Duration's sensitivity characteristic reveals how the interest rate allocates scarce resources across time. The interest rate acts as a key market signal by incentivizing entrepreneurs to undertake

FIGURE 16

Project Cash Flow
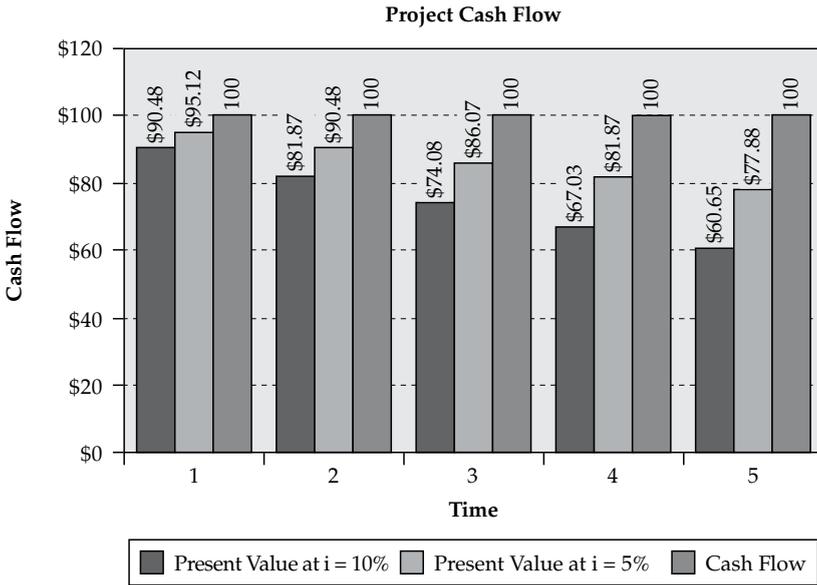
projects consistent with consumer desires.[19] It tells entrepreneurs that consumers have reduced consumption and increased savings. An increase in project duration tells entrepreneurs that consumers want relatively more future goods and relatively fewer present goods. Entrepreneurs will respond by taking on longer duration investment projects. Entrepreneurs can take on longer duration projects because savers have provided additional present goods. These present goods provided by savers sustain entrepreneurs and laborers during the longer production process.

Socialism is an institutionalized system of property title redistribution. On the other hand, capitalism is a system of property title recognition.[20] Private property is necessary for the formation of market prices. Private property allows for voluntary exchange. Each voluntary exchange results in an exchange ratio. For instance, suppose 200 is exchanged for 1 machine. The exchange ratio is:

$$\text{Exchange Ratio} = 200/\text{Machine}$$

This exchange ratio is a market price. The price of 1 machine is 200. These market prices can be used by entrepreneurs in economic calculation.

Capital budgeting is impossible without private property. Voluntary exchange cannot occur without private property. As a result there are no exchange ratios; there are no market prices. It is impossible to forecast the future cash flows from each investment project because there are no market prices. Capital budgeting techniques like NPV and Duration can't be conducted without forecasting cash flows. It is impossible to rank investment projects without private property. The grading function provided by economic calculation cannot exist without private property.[21]

Credit expansion is an increase in the money supply where the new money enters through loan markets. Banks expand credit by creating new demand deposits (checking accounts) unbacked by real savings.[22] Demand deposits are money, and money is the present good par excellence. Credit expansion therefore constitutes an increase in the supply of present goods. Credit expansion causes the supply curve to shift right from S to S_m.[23] The original Supply curve still represents the amount of real savings.

FIGURE 17
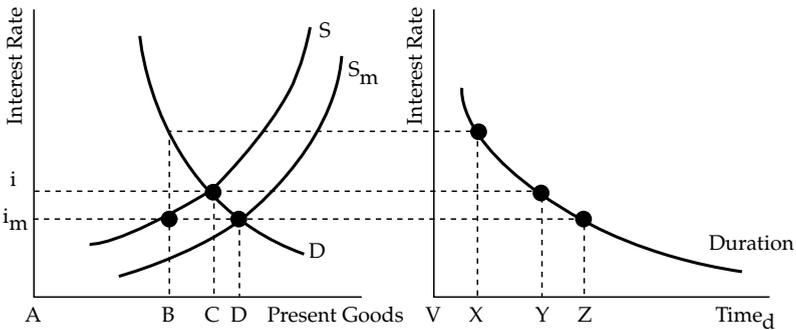
Credit expansion encourages entrepreneurs to undertake more projects. The new level of investment increases from line AC to AD. Not only do entrepreneurs take on more projects, they undertake projects with different time profiles. Entrepreneurs

are incentivized to undertake longer duration projects at lower rates. This is represented by an increase in project duration from line VY to line VZ.

However, consumers do not demand more future goods and have not provided the necessary present goods entrepreneurs need to complete longer duration projects. In fact, the quantity of real savings supplied falls at the artificially low rate.[24] The original amount of real savings provided by savers is line AC. The new quantity of real savings supplied by savers falls to line AB. Savers originally provide enough real savings to sustain entrepreneurs and laborers for time VY. Now savers only supply a quantity of savings for time VX.

The level of investment is greater than the level of real savings. Line BD is the shortage of real savings.[25] Consumers want to receive present goods in time VX, but entrepreneurs are undertaking projects to provide present goods at time VZ. The time discrepancy between consumer desires and entrepreneur's investment projects is XZ.

The bust occurs when entrepreneurs realize the shortage of present goods. Entrepreneurs scramble to acquire the present goods required to complete their longer duration projects. This increase in the demand for present goods causes the interest rate to rise. Entrepreneurs realize the projects they entered were not undervalued compared to consumer desires. In fact, capital budgeting techniques now tell entrepreneurs that short duration projects are now undervalued compared to consumer desires. Entrepreneurs must realign their activities with consumer desires. This necessarily entails liquidating malinvestments and reallocating any salvageable resources to profitable projects. Entrepreneurs must liquidate their malinvestments at a loss.[26] These projects must be liquidated at a loss.[27]

The boom is a period of mass resource misallocation. Artificially low interest rates distort economic calculation thereby causing mass entrepreneurial error.[28] The bust is a period where entrepreneurs realign their activity with the desires of consumers. The bust is a necessary adjustment period in which malinvestments are liquidated. Credit expansion distorts economic calculation thereby causing the boom bust cycle.

Duration can be used to illustrate the effects of additional credit expansion during an economic bust.

FIGURE 18
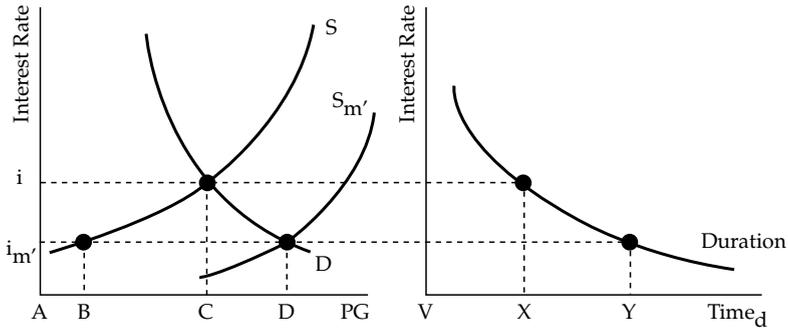
The duration curve is more elastic at lower interest rates. Additional credit expansion during a bust incentivizes entrepreneurs to undertake projects with even longer effective periods of production. This means entrepreneurs take on even more interest rate sensitive projects. The losses in more interest rate sensitive projects will be magnified when interest rates inevitably rise.[29] The liquidation phase is exacerbated as losses are enhanced when interest rates finally rise.[30] In short, additional bouts of credit expansion during a bust only encourage more malinvestment and delay recovery.

The interest rate allocates scarce resources across time. Capital budgeting techniques used in economic calculation are entrepreneurial indicators. Tools like Net Present Value and Duration transmit the desires of consumers to entrepreneurs. The interest rate plays a vital role in these capital budgeting techniques. Artificially low interest rates caused by credit expansion skews the results of the entrepreneur's capital budgeting process. Credit expansion inevitably results in the mass misallocation of resources.

NOTAS

[1] If this were not true, capital assets like land would have infinite capital values.

[2] For more on the Time Market Diagram, see: Rothbard, Murray N. *Man, Economy, and State: A Treatise on Economic Principles; with Power and Marke*. Auburn: Ludwig von Mises Institute, 2004, p. 388)

> «the market of present and future goods, in which the interest rate is determined, *consists of society's entire structure of productive stages*, in which savers or capitalists give up immediate consumption and offer present goods to owners of the primary or original factors of production (workers and owners of natural resources) and to owners of capital goods, in exchange for the full ownership of consumer (and capital) goods of a supposedly higher value once the production of these goods has been completed in the future.» (Huerta de Soto, J. *Money, Bank Credit, and Economic Cycles*. Auburn: Ludwig von Mises Inst., 2006, p. 286).

[3] «Economic calculation is either an estimate of the expected outcome of future action or the establishment of the outcome of past action.» (Mises, Ludwig von. *Human Action: A Treatise on Economics*. Auburn, Ala: Ludwig Von Mises Institute, 1998, p. 211).

[4] The Net Present Value (NPV) is the sum of the present values of all cash inflows and outflows from an investment project. Entrepreneurs will generally undertake projects with a positive NPV and reject projects with a negative NPV. However, the NPV does not measure the value of an investment project. The NPV can be used to rank or grade projects, but it cannot be used to measure value. The net present value (NPVA) of an annuity style investment project is:

$$NPVA = \frac{f(1 - e^{-i*t})}{e^i - 1} - C$$

Where:

f = Cash Flow i = interest rate
t = Project years C = Initial cost

$$NPV(10\%) = \frac{10_0(1 - e^{-.1*5})}{e^{.1} - 1} - 200 = 174.12$$

$$NPV(5\%) = \frac{10_0(1 - e^{-.05*5})}{e^{.1} - 1} - 200 = 231.43$$

[5] Macaulay, Frederick R. *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields, and Stock Prices in the United States Since 1856*. New York: Columbia University Press, 1938.

[6] For more on duration, see: Das, Sanjiv R. *Derivatives: Principles and Practice*. New York: McGraw-Hill Irwin, 2011, p. 141 and 150; Hull, John. *Options, Futures, and Other Derivatives*. Upper Saddle River, N.J: Pearson/Prentice Hall, 2006, p. 89.

^{7} Stickney, Clyde. «Duration and Risk Assessments in Capital Budgeting». *The Accounting Review*, vol. 54, n.º 1 (Jan., 1979): 180-188.

^{8} *PV* is the present value of a future cash flow. *PV'(i)* is the first deriviative of the *PV(i)*. Note *MPV'* is just a function of time.

$$PV = f\,e^{-it}$$

$$PV'(i) = -tf\,e^{-it}$$

$$D(i) = \frac{PV'(i)}{-PV(i)} = \frac{-tf\,e^{-it}}{-f\,e^{-it}} = t$$

$$D = t$$

Similary, the present value of an annuity is *PVA*. *PVA(i)* is the first derivative of *PVA(i)*. *D(i)* is the duration of an annuity:

$$PVA = \frac{f(1 - e^{-it})}{e^i - 1}$$

$$PVA'(i) = \frac{(tf\,e^{-it})(e^i - 1) + (f - f\,e^{-it})(e^i)}{(e^i - 1)^2}$$

$$D'(i) = \frac{PVA'(i)}{-PVA(i)}$$

$$D = \frac{e^i(e^{it} - 1) + t\,(1 - e^i)}{(e^i - 1)(e^{it} - 1)}$$

Thanks to Robert Whitten. Any mistakes are the author's alone.

^{9} Duration, as a measure of interest rate sensitivity, must be corrected for Convexity over large changes in interest rates.

^{10} For example, the present value of an investment project will increase by 10% if project duration is 10 and interest rates fall by 1 percentage point. Suppose project duration is 30 and interest rates fall by 1 percentage point. The present value of the project will increase by 30%. Entrepreneurs use duration to measure how changes in interest rates will affect the value of their assets and liabilities, and therefore their capital.

^{11} There are 5 rules regarding duration:

1. The duration of a single cash flow project is equal to the time to maturity
2. All else equal, when interest rates rise project duration falls.
3. All else equal, the longer the term to maturity of a project the greater its duration.
4. All else equal, the higher the project cash flows the shorter the bond's duration.
5. Duration is additive: The duration of a portfolio of projects is the weighted average of the durations of the individual projects.

[12] The duration of a zero coupon bond is equal to the bond's maturity. For example, a one year zero coupon bond has duration of one, and a five year zero coupon bond has duration of five. This means if interest rates increase by one percentage point, the present value of the one year zero coupon will fall by 1%. The price of the five year zero coupon bond will decrease by 5%.

[13]

$$D(10\%) = \frac{e^{.1}(e^{.1*5} - 1) + t(1 - e^{.1})}{(e^{.1} - 1)(e^{.1*5} - 1)} = 2.8$$

[14]

$$D(5\%) = \frac{e^{.05}(e^{.05*5} - 1) + t(1 - e^{.05})}{(e^{.05} - 1)(e^{.05*5} - 1)} = 2.9$$

[15] Duration's additive property is useful because the duration of multiple projects can be easily calculated from the durations of the individual projects. The duration of multiple (or society's) investment projects is the weighted average of the durations of the individual projects. The weights are equal to each project's percentage of the entire portfolio in present value terms. Suppose an entrepreneur has two projects in his portfolio. Project A has a duration of 10 year and represents 40% of his project portfolio. Project B has a duration of 20 years and represents 60% of his project portfolio. The duration of the two project portfolio is:

Portfolio Duration = (10 * .4) + (20 * .6) = 16 *years*

[16] «A reduction of the rate of interest on loans must necessarily lead to a lengthening of the average period of production.» (Mises, Ludwig von. *The Theory of Money and Credit*. Liberty Classics edition. Indianapolis: Liberty Fund, 1981, p. 400).

[17] «The rate of originary interest directs the investment activities of the entrepreneurs. It determines the length of waiting time and of the period of production in every branch of industry» (Mises, Ludwig von. *Human Action: A Treatise on Economics*. Auburn, Ala: Ludwig Von Mises Institute, 1998, p. 529).

[18] Entrepreneurs respond to increased savings in two ways. First, they reduce later stage investment. This reduction in late stage investment is called the Derived Demand Effect. Second, the lower interest rates also encourage early stage investment. This is called the Time Discount Effect. The Derived Demand Effect and Time Discount Effect are both captured using duration. A fall in interest rates leads to an increase in the demand for factors late on the duration timeline and a decrease in demand for factors early on the duration time line.

[19] «The more plentiful the savings, i.e., the greater the quantity of present goods sold or offered for sale, other things being equal, the lower their price in terms of future goods; and consequently, the lower the market rate of interest. This indicates to entrepreneurs that more present goods are available, which enables them to increase the length and complexity of the stages in their production processes, making these stages more productive» (Huerta de Soto, J. *Money, Bank Credit, and Economic Cycles*. Auburn: Ludwig von Mises Inst, 2006, p. 290).

[20] Hoppe, Hans-Hermann. *A Theory of Socialism and Capitalism: Economics, Politics, and Ethics*. Boston: Kluwer Academic Publishers, 1989.

[21] «Where there is no market there is no price system, and where there is no price system there can be no economic calculation» (Mises, Ludwig von. *Socialism: An Economic Sociological Analysis*. Indianapolis: Liberty Classics, 1981, p. 113).

[22] The fragility of fractional reserve banking systems can be illustrated using duration Gap Analysis. The duration of a demand deposit is zero. Fractional reserve bank liabilities are by definition shorter duration than bank assets.

Suppose the duration of a bank's assets is 10 years and the duration of the bank's liabilities is 0. Suppose there are 100 million in assets and 90 million in liabilities. With a 2 percentage point increase in interest rates, the capital value of the bank's assets will decrease by 20% (-2% x 10=-20%), or 20 million. The capital value of the bank's liabilities will not fall. The bank now has 80 million in assets and 90 million in liabilities. Bank equity is negative 10 million and the bank is bankrupt.

Gap Analysis indicates that it is impossible to completely mitigate the interest rate risk associated with fractional reserve banking. Fractional reserve banks create demand deposits when they make loans. This means they create zero duration liabilities when they make longer duration loans. Other things equal, a bank is always more interest rate sensitive after engaging in fractional reserve banking. Fractional reserve banking creates interest rate risk that can be sliced and diced, but never destroyed.

«Another way of looking at the essential and inherent unsoundness of fractional reserve banking is to note a crucial rule of sound financial management—one that is observed everywhere *except* in the banking business. Namely, *that the time structure of the firm's assets should be no longer than the time structure of its liabilities*.» (Rothbard, Murray N. *The Mystery of Banking*. New York, N.Y: Richardson & Snyder, 1983, p. 10).

For more on Duration Gap Analysis, see: Mishkin, Frederic S. *The Economics of Money, Banking, and Financial Markets*. 7th edition, Boston: Pearson, 2004, p. 222.

[23] «Superficially, it seems that credit expansion greatly increases capital, for the new money enters the market as equivalent to new savings for lending. Since the new "bank money" is apparently added to the supply of savings on the credit market, businesses can now borrow at a lower rate of interest» (Rothbard, Murray N. *Man, Economy, and State: A Treatise on Economic Principles; with Power and Market : Government and the Economy*. Auburn: Ludwig von Mises Institute, 2004, p. 993).

[24] «Some resources are bid away from the intermediate and relatively late stages of production and into the early stages. At the same time, income earners, for whom that same lower interest rate discourages saving, spend more on consumption… the restructuring cannot actually be completed. The boom is unsustainable; the changes in the intertemporal structure are self defeating. Resource scarcities and a continuing high demand for current consumption eventually turn boom into bust.» (Garrison, Roger W. *Time and Money: The Macroeconomics of Capital Structure*. London: Routledge, 2001, p. 72).

[25] «Despite the fact that there has been no increase of intermediate products and there is no possibility of lengthening the average period of production, a rate of interest is established in the loan market which corresponds to a longer period of production; and so, although it is in the last resort inadmissible and impracticable, a lengthening of the period of production promises for the time to be profitable. But there cannot be the slightest doubt as to where this will lead. A time must necessarily come when the means of subsistence available for consumption are all used up although the capital goods employed in production have not yet been transformed into consumption goods. This time must come all the more quickly inasmuch as the fall in the rate of

interest weakens the motive for saving and so slows up the rate of accumulation of capital. The means of subsistence will prove insufficient to maintain the labourers during the whole period of the process of production that has been entered upon.» (Mises, Ludwig von. *The Theory of Money and Credit*. Liberty Classics edition. Indianapolis: Liberty Fund, 1981, p. 401).

[26] «This situation is very similar to the one in which our Robinson Crusoe would find himself if, having saved a basket of berries large enough to permit him to spend a maximum of five days producing a capital good without having to devote himself to the collection of more berries, *through an error in calculation* were to believe that this amount of savings would allow him to undertake the construction of his cabin. After five days spent just digging the foundations and gathering materials, he would have consumed all of his berries and would therefore be unable to complete his illusory investment project» (Huerta de Soto, J. *Money, Bank Credit, and Economic Cycles*. Auburn: Ludwig von Mises Institute, 2006, p. 377).

[27] «It is not practicable to transfer all the production goods from those uses that have proved unprofitable into other avenues of employment; a part of them cannot be withdrawn and must therefore either be left entirely unused or at least be used less economically. In either case there is a loss of value.» (Mises, Ludwig von. *The Theory of Money and Credit*. Liberty Classics edition. Indianapolis: Liberty Fund, 1981, p. 400).

[28] «The drop in interest rates falsifies the businessman's calculation. Although the amount of capital goods available did not increase, the calculation employs figures which would be utilizable only if such an increase had taken place. The result of such calculations is therefore misleading. They make some projects appear profitable and realizable which a correct calculation, based on an interest rate not manipulated by credit expansion, would have shown as unrealizable. Entrepreneurs embark upon the execution of such projects. Business activities are stimulated. A boom begins.» (Mises, Ludwig von. *Human Action: A Treatise on Economics*. Auburn: Ludwig Von Mises Institute, 1998, p. 550).

[29] «entrepreneurs experience resource scarcities that are more constraining than was implied by the pattern of wages, prices, and interest rates that characterized the early phase of the boom. Here, changing expectations are clearly endogenous to the process. The bidding for increasingly scarce resources and the accompanying increased demands for credit put upward pressure on the interest rate.» (Garrison, Roger W. *Time and Money: The Macroeconomics of Capital Structure*. London: Routledge, 2001, p. 72).

[30] «Capital goods prices will increase initially relative to consumer goods prices, but once the public's underlying time preference rate begins to reassert itself, a systematic shortage of consumer goods will arise. Accordingly, the interest rate will adjust upward, and it is now consumer goods prices which rise relative to capital goods price, requiring the liquidation of part of the investment as unsustainable malinvestment» (Hoppe, Hans-Hermann. *The Economics and Ethics of Private Property: Studies in Political Economy and Philosophy*. Auburn: Ludwig von Mises Institute, 2006, p. 199).