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Loan Amortisation and Debt Financing Strategy for Capital Investments

Practical Analytical Report (Financial Analysis Project) – Assignment Option 1

Companion spreadsheet: 7. Financial Mathematics Option 1 Spreadsheet

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Executive Summary

This report evaluates how a €4 million renovation of a fictional coastal hotel, Hotel Seeblick, should be financed and repaid. A €3 million, 10-year commercial loan at 5% is modelled under the French (annuity), German (linear) and American (bullet) amortisation systems, and the results are tested against interest-rate changes, inflation, grace periods and loan fees. The German system has the lowest total interest (€825,000) and the American the highest (€1,500,000), with the French system in between (€885,137). However, the decisive constraint is cash flow: because the hotel earns little while it is partly closed, every standard schedule fails a 1.5× debt-service coverage test in the first years, and the American system ends with a €3 million repayment that the hotel cannot fund from operations. A one-percentage-point rise in the interest rate adds about €191,000 of interest over the term, while 2% inflation reduces the real cost of the loan to about 2.9% a year. Real-world cases (TUI and Thomas Cook) show that service firms survive shocks when debt is matched to cash generation and equity is used to restore balance-sheet strength. The recommended strategy is **75% debt and 25% equity**, with the loan structured as a **fixed-rate French annuity after a two-year interest-only grace period** (minimum coverage 1.51×), and a negotiated right to make special repayments once trading stabilises.

1. Introduction

Hotels and resorts must invest heavily and regularly to stay competitive: rooms, energy systems and public areas need renovating roughly every ten to fifteen years. These investments are usually too large to fund from retained profits, so owners borrow. The way a loan is repaid, its amortisation system, determines how much cash the business must pay each year and how much interest it pays in total. For a seasonal, cash-sensitive business, choosing the wrong schedule can create a liquidity crisis even when the investment itself is profitable.

This report has three objectives, following the assignment brief: (1) to develop and contrast French, German and American amortisation schedules for a commercial loan; (2) to evaluate how interest-rate variability, inflation, grace periods and supplementary financing costs affect total debt service; and (3) to examine real-world capital strategies of service-sector firms and give a spreadsheet-based financing and repayment recommendation. The case is fictional; all assumptions are listed in the companion spreadsheet, where they can be changed to test other scenarios.

2. Theoretical Framework & Financial Laws

2.1 Laws of interest and capitalisation

Under the **simple interest** law, interest is proportional to the principal and time, $I = C_0 \cdot i \cdot t$, and is not reinvested. Under the **compound interest** law, interest is added to the capital and earns interest itself, so $C_n = C_0(1 + i)^n$. Long-term loans are always calculated with compound interest. Where interest is charged m times a year at nominal rate j, the equivalent annual rate is $i = (1 + j/m)^m - 1$. The principle of **financial equivalence** states that two payment streams are equivalent if their present values are equal at the same rate; every amortisation schedule is therefore a different way of repaying the same present value, $C_0 = \Sigma\, a_t(1 + i)^{-t}$ (Brealey et al., 2020).

2.2 Amortisation systems

- **French system (annuity).** Every payment is equal: $a = C_0 \cdot i \div (1 - (1 + i)^{-n})$. Interest falls and principal rises over time. For a €3,000,000 loan at 5% over 10 years, a = €388,514.
- **German system (linear).** The principal repaid is constant, $C_0 \div n$, so interest and total payments fall each year. The first payments are the highest.
- **American system (bullet).** Only interest is paid during the term and the whole principal is repaid at maturity. To prepare for the final payment, a borrower can build a **sinking fund**, saving $s = C_0 \cdot r \div ((1 + r)^n - 1)$ per year at deposit rate r; at 2.5% this is €267,776 a year.

2.3 Factors affecting the cost of debt

Four further factors change the true cost of a loan. **Interest-rate variability** matters when the rate is linked to a reference rate such as Euribor: payments and total interest change when the reference rate moves. **Inflation** reduces the real value of future payments; by the Fisher relationship, the real rate is $(1 + i) \div (1 + \pi) - 1$, so borrowers at fixed rates gain when inflation is higher than expected. **Grace periods** postpone principal repayment (partial grace, interest only) or both principal and interest (total grace, interest capitalised), easing early cash flow at the price of more total interest. **Supplementary costs** such as arrangement fees, valuation fees and account or insurance charges raise the effective cost above the nominal rate; the effective annual rate is the internal rate of return (IRR) that equates the net amount received with all payments made.

2.4 Debt versus equity

Debt is cheaper than equity because interest is tax-deductible and lenders face less risk, but Modigliani and Miller (1958) showed that, without taxes and distress costs, more debt simply raises the required return on equity. In practice, trade-off theory holds that firms borrow until the tax benefit is offset by the expected costs of financial distress, while the pecking-order theory observes that firms prefer internal funds, then debt, then equity (Myers, 1984). Lenders judge debt capacity mainly by the **debt-service coverage ratio** (DSCR = EBITDA ÷ annual interest and principal); 1.5× is a common minimum for hotel loans.

3. Financial Calculations & Scenario Analysis

3.1 Case assumptions

Hotel Seeblick (fictional) plans a €4,000,000 renovation, financed with €1,000,000 of the owners' equity and a €3,000,000 bank loan over 10 years at a fixed 5% with annual payments. During the works the hotel is partly closed, so EBITDA is expected to be €350,000 in year 1, €600,000 in year 2 and €700,000 from year 3, growing by 2% a year thereafter. The bank charges a 1.5% arrangement fee plus a €5,000 valuation (€50,000 in total) and €3,000 a year in account and insurance fees.

3.2 French, German and American schedules

Table 1. Comparison of amortisation systems (€3,000,000, 5%, 10 years)

Measure	French	German	American
Payment year 1	€388,514	€450,000	€150,000
Payment year 10	€388,514	€315,000	€3,150,000
Total interest	€885,137	€825,000	€1,500,000
Total payments	€3,885,137	€3,825,000	€4,500,000
Effective cost incl. fees (IRR)	5.51%	5.54%	5.32%
Minimum DSCR	0.90× (yr 1)	0.78× (yr 1)	0.26× (yr 10)

The German system repays capital fastest and therefore pays the least interest, €60,137 less than the French system, but its first payment of €450,000 is the heaviest burden in exactly the year the hotel earns least. The American system has the lowest annual payments (€150,000) but pays interest on the full €3 million for ten years, costing €1,500,000, and leaves a final payment of €3,150,000. Unless the hotel refinances or builds a sinking fund of about €267,776 a year, the American loan creates a severe refinancing risk at maturity. The French system offers predictable payments, which suit budgeting, but still fails the coverage test in year 1 (0.90×).

The effective rates show a counter-intuitive result: the American loan has the lowest effective annual cost (5.32%) despite the highest total interest. This is because the upfront fee is spread over a longer average period of borrowing. Total interest and effective rate answer different questions (how much is paid in total versus how expensive each euro of borrowing is per year), and managers need both.

3.3 Interest-rate variability

Table 2. Sensitivity of the French loan to the interest rate (fixed for the full term)

Interest rate	Annual payment	Total interest	Change vs 5%
4%	€369,873	€698,728	−€186,409
5%	€388,514	€885,137	€0
6%	€407,604	€1,076,039	€190,901
7%	€427,133	€1,271,325	€386,188

Each percentage point adds roughly €190,000 of interest over the term. If the loan were variable and rates rose by two points from year 3, the payment would rise from €388,514 to €420,519 and total interest would increase to €1,141,183. A fall of one point would reduce total interest to €760,710. Recent history shows that such moves are realistic: the ECB raised its deposit rate from −0.50% in mid-2022 to 4.00% in September 2023 (European Central Bank, 2023). For a business with thin coverage, a fixed rate provides valuable certainty.

3.4 Inflation

Table 3. Real burden of debt service: present value of payments discounted at the inflation rate

Inflation	Real interest rate	French	German	American
2%	2.94%	€3,489,858	€3,457,837	€3,808,433
4%	0.96%	€3,151,194	€3,141,683	€3,243,327

With a fixed 5% rate and 2% inflation, the real cost of borrowing is only 2.94% a year; with 4% inflation it falls below 1%. Inflation helps the borrower most under the American system, because the large final payment is made in money that has lost the most value: at 4% inflation its real burden falls from €3.81 million to €3.24 million. In the hotel industry, inflation also tends to raise room rates and therefore EBITDA, so moderate inflation improves debt coverage over time. The opposite risk is that inflation pushes up central-bank rates, which hurts variable-rate borrowers (Section 3.3).

3.5 Grace periods

Table 4. Effect of grace periods on the French loan

Structure	Payment yr 1	Annuity afterwards	Total interest	Minimum DSCR
No grace	€388,514	€388,514	€885,137	0.90×
1-year interest only	€150,000	€422,070	€948,632	1.42×
2-year interest only	€150,000	€464,165	€1,013,324	1.51×
2-year total grace (capitalised)	€0	€511,742	€1,093,939	–

A two-year interest-only grace period lifts the minimum DSCR from 0.90× to 1.51× because the hotel pays only €150,000 a year while it is being renovated and reopened. The price is €128,186 of extra interest. A total grace period (interest capitalised) is more expensive still, because interest is charged on unpaid interest, and it raises the later annuity to €511,742.

3.6 Supplementary financing costs

Fees of €50,000 upfront and €3,000 a year raise the effective cost of the French loan from 5.00% to 5.51%, and of the recommended structure to 5.45%. Total cost including fees is €965,137 for the plain French loan and €1,093,324 for the French loan with two years' grace. Comparing offers on their effective rate rather than the headline rate avoids choosing a loan that looks cheap but carries high charges.

3.7 Real-world capital strategies in service firms

Two European tour operators illustrate how capital structure determines survival. **Thomas Cook** collapsed in September 2019 because it could not service debts of around £1.6 billion, built up through mergers and earlier rescues, while it carried the fixed costs of hundreds of high-street shops and faced weaker demand (Financier Worldwide, 2019). Debt had been used to postpone rather than solve structural problems. **TUI**, by contrast, survived the pandemic with three German state stabilisation packages worth around €4.3 billion and then rebuilt its balance sheet with equity: a capital increase of about €1.8 billion in April 2023 allowed it to repay the remaining aid from the Economic Stabilisation Fund in full and reduce its credit lines (TUI Group, 2023). Once rates had risen, replacing expensive debt with equity lowered interest costs and restored flexibility. Both cases support the trade-off view: debt is useful, but only up to the level that cash flows can carry in a bad year.

4. Discussion & Managerial Implications

The calculations show that the cheapest loan on paper is not the best one for this hotel. The German system minimises interest, but its high early payments coincide with the renovation, when income is lowest. The American system minimises annual payments but moves almost all the risk to year 10, when the hotel would need to refinance €3 million at whatever rates then prevail. The French system balances these extremes and makes budgeting easy, but on its own it still breaks the coverage covenant in year 1.

The managerial lesson is to **match the repayment profile to the investment's cash-flow profile**. A renovation produces little in its first two years and stable income afterwards; a French annuity that starts after a two-year interest-only period mirrors that pattern. The extra €128,000 of interest is effectively an insurance premium against a liquidity crisis, which is far cheaper than the cost of a covenant breach or emergency refinancing.

Interest-rate and inflation risks pull in different directions. A fixed rate protects the hotel against the kind of rate increases seen in 2022–2023, while moderate inflation, if it raises room rates, will gradually reduce the real burden of fixed payments. Managers should therefore fix the rate for the full term where the premium over a variable rate is modest, and should include a right to make special repayments so that the loan can be reduced if trading is better than expected.

The capital-structure decision follows the same logic. With 75% debt, debt equals more than four times year-3 EBITDA, which is acceptable for a property-backed hotel loan but leaves limited room for further borrowing. The owners' €1 million equity is therefore essential: reducing it would increase payments beyond what the hotel's cash flows can cover. The TUI and Thomas Cook cases show that equity, although more expensive, is what allows a service business to survive a downturn.

The analysis has limitations. Annual rather than monthly payments are assumed, tax effects on interest are not modelled, and the EBITDA forecast is uncertain. The spreadsheet allows each assumption to be changed, and a full feasibility study would add a downside EBITDA scenario.

5. Conclusion & Recommendations

Loan amortisation systems redistribute the same debt over time in very different ways. For Hotel Seeblick, the German system is cheapest in total, the American system is the riskiest, and the French system is the most predictable. Interest-rate changes, inflation, grace periods and

fees all materially change the true cost of debt, and must be modelled before signing. The following strategy is recommended:

1. Finance the €4,000,000 renovation with **€3,000,000 of debt and €1,000,000 of equity**; do not reduce the equity share.
2. Use a **French annuity loan with a two-year interest-only grace period**, giving annual payments of €150,000 in years 1–2 and €464,165 in years 3–10, and a minimum DSCR of 1.51×.
3. **Fix the interest rate** for the full 10-year term to remove exposure to rising reference rates.
4. Compare all bank offers on their **effective annual rate including fees**, and negotiate the arrangement fee.
5. Negotiate an annual **special-repayment right** (e.g. 5% of the original loan) and use it after strong seasons to reduce total interest.
6. Update the spreadsheet quarterly with actual EBITDA and keep a cash reserve equal to at least six months of debt service.

References

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Appendices (Spreadsheet Output & Amortisation Schedules)

Appendix A – French system

Year	Opening balance	Interest	Principal	Payment	Closing balance	DSCR
1	€3,000,000	€150,000	€238,514	€388,514	€2,761,486	0.90×
2	€2,761,486	€138,074	€250,439	€388,514	€2,511,047	1.54×
3	€2,511,047	€125,552	€262,961	€388,514	€2,248,085	1.80×
4	€2,248,085	€112,404	€276,109	€388,514	€1,971,976	1.84×
5	€1,971,976	€98,599	€289,915	€388,514	€1,682,061	1.87×
6	€1,682,061	€84,103	€304,411	€388,514	€1,377,650	1.91×
7	€1,377,650	€68,883	€319,631	€388,514	€1,058,019	1.95×
8	€1,058,019	€52,901	€335,613	€388,514	€722,406	1.99×
9	€722,406	€36,120	€352,393	€388,514	€370,013	2.03×
10	€370,013	€18,501	€370,013	€388,514	€0	2.07×
Total		€885,137	€3,000,000	€3,885,137		

Appendix B – German system

Year	Opening balance	Interest	Principal	Payment	Closing balance	DSCR
1	€3,000,000	€150,000	€300,000	€450,000	€2,700,000	0.78×
2	€2,700,000	€135,000	€300,000	€435,000	€2,400,000	1.38×
3	€2,400,000	€120,000	€300,000	€420,000	€2,100,000	1.67×
4	€2,100,000	€105,000	€300,000	€405,000	€1,800,000	1.76×
5	€1,800,000	€90,000	€300,000	€390,000	€1,500,000	1.87×
6	€1,500,000	€75,000	€300,000	€375,000	€1,200,000	1.98×
7	€1,200,000	€60,000	€300,000	€360,000	€900,000	2.10×
8	€900,000	€45,000	€300,000	€345,000	€600,000	2.24×
9	€600,000	€30,000	€300,000	€330,000	€300,000	2.39×
10	€300,000	€15,000	€300,000	€315,000	€0	2.55×
Total		€825,000	€3,000,000	€3,825,000		

Appendix C – American system

Year	Opening balance	Interest	Principal	Payment	Closing balance	DSCR
1	€3,000,000	€150,000	€0	€150,000	€3,000,000	2.33×
2	€3,000,000	€150,000	€0	€150,000	€3,000,000	4.00×
3	€3,000,000	€150,000	€0	€150,000	€3,000,000	4.67×
4	€3,000,000	€150,000	€0	€150,000	€3,000,000	4.76×
5	€3,000,000	€150,000	€0	€150,000	€3,000,000	4.86×
6	€3,000,000	€150,000	€0	€150,000	€3,000,000	4.95×
7	€3,000,000	€150,000	€0	€150,000	€3,000,000	5.05×
8	€3,000,000	€150,000	€0	€150,000	€3,000,000	5.15×
9	€3,000,000	€150,000	€0	€150,000	€3,000,000	5.26×
10	€3,000,000	€150,000	€3,000,000	€3,150,000	€0	0.26×
Total		€1,500,000	€3,000,000	€4,500,000		

Sinking fund to accumulate €3,000,000 by year 10 at 2.5%: €267,776 per year (=PMT(2.5%,10,0,−3,000,000)).

Appendix D – Recommended: French system after 2-year interest-only grace

Year	Opening balance	Interest	Principal	Payment	Closing balance	DSCR
1	€3,000,000	€150,000	€0	€150,000	€3,000,000	2.33×
2	€3,000,000	€150,000	€0	€150,000	€3,000,000	4.00×
3	€3,000,000	€150,000	€314,165	€464,165	€2,685,835	1.51×
4	€2,685,835	€134,292	€329,874	€464,165	€2,355,961	1.54×
5	€2,355,961	€117,798	€346,367	€464,165	€2,009,593	1.57×
6	€2,009,593	€100,480	€363,686	€464,165	€1,645,908	1.60×
7	€1,645,908	€82,295	€381,870	€464,165	€1,264,038	1.63×
8	€1,264,038	€63,202	€400,964	€464,165	€863,074	1.67×
9	€863,074	€43,154	€421,012	€464,165	€442,062	1.70×
10	€442,062	€22,103	€442,062	€464,165	€0	1.73×
Total		€1,013,324	€3,000,000	€4,013,324		

Appendix E – Key spreadsheet formulas

Calculation	Excel formula
French principal in year t	=PMT(rate, years remaining, −opening balance) − interest
German principal	=loan / term
American principal	=IF(year = term, opening balance, 0)
Grace period principal	=IF(year <= grace, 0, PMT(rate, term − year + 1, −balance) − interest)
Effective cost incl. fees	=IRR(net proceeds, payments + fees)
Real burden at inflation	=NPV(inflation, payments)
Real interest rate	=(1 + i)/(1 + π) − 1
DSCR	=EBITDA / total payment

All schedules, scenarios and summary figures are reproduced with live formulas in Financial*Mathematics*Option1_Spreadsheet.xlsx; inputs are marked blue on yellow.