FINANCIAL MATHEMATICS

Financial Capital Equivalence and Short-Term Liquidity Management

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Programme/Course: Bachelor of Business Administration and Management

Submission date: 11/04/2026

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Executive Summary

This assignment is a test of the financial capital equivalence and short-term liquidity planning of the tour operator company in Germany, who is affected by seasonal cash-flow pressures. It provides a comparison between simple and compound interest, commercial and rational bill discounting and the solution of problems involving replacement of staggered liabilities by economically equivalent settlement schedules. The analysis is based on evidence shared voluntarily with the public by the TUI Group, plus an independent, strictly hypothetical travel-company model. The two should not be confused with either the same entity or financial information.

This Excel spreadsheet demonstrates that an amount of €100,000 payable in 90 days at 9% commercial discount rate is equivalent to an amount of €97,750 discounted rationally at 9%. The three supplier commitments have a total value of €110,000 and a common-date present value of €108,189.61 provided that the stated nominal rate is 7.2% compounded at 30-day intervals. The interest on a six payment €80,000 loan is around €2,113.08. The base case cash trough in the 13-week forecast is set at €32,000 while the adverse receipts scenario is reduced to negative €40,000. The model thus needs up to €90,000 in available contingent funds to uphold the floor of €50,000 in liquidity. These are plan outputs, NOT market quotes or actual results. The suggested solution includes rolling forecasts, bank-line headroom, and restricted-cash monitoring and disciplined refinancing decisions.

1. Introduction

Travel companies spend money on suppliers' reservations, on airline allocations, on staffing, on distribution, on customer service, and more, before cash has been realized. This can make it difficult to predict cash flow in a seasonal business: cash can come in one month, and the delivery of travel may take place months later, or reimbursements or settlement dates can come and go in the middle of the month. Hence, accounting profit is not a guarantee of short-term solvency and a positive bank balance is not the same as a positive earnings flow. Capital needs to be valued at the same time and financing needs to be synchronized to the business cycle.

Germany is a relevant context. Provisional results for 2025 show the total number of overnight stays of all guests was 497.5 million, which is 0.3% more than in 2024 (Federal Statistical Office, 2026). High aggregate passenger traffic does not mean that there will be no cash shortages at individual operators. It covers the calculation needs in context of a hypothetical company “Berlin Travel GmbH” and assesses the existing liquidity management in reality based on the published annual accounts for the TUI Group for the year 2025. The aim is to establish the guidance for practical financial decisions that is available to follow in the light of interest laws, commercial-paper discounting, equivalent-payment modelling and stress-tested cash management.

2. Theoretical Framework and Financial Laws

2.1 Simple and compound interest

Simple interest is computed on the initial principal only. If P denotes principal, r an annual rate and t the fraction of a year, the interest is $I = P \times r \times t$ and the maturity value is $FV = P(1 + rt)$. Compound interest, on the other hand, compounds interest on the prevailing balances: $FV = P(1 + r/m)^{(mt)}$, where m is the number of times per year the interest is compounded (OpenStax, 2023a, 2023b). If the cost of funding will therefore rise over any number of full periods, it will vary according to the convention if the comparison is to be made over shorter durations. A fractional annual-effective exponent and an ACT/360 simple accrual are not "equal," meaning comparing the two without stating the frequency of the compounding can cause confusion for managers.

The calculations make the explicit assumption of ACT/360 in the short-term example, which amounts to actual days/360. The basis is typically the same as that of euro unsecured money-market deposits, but this is determined by the contract or instrument to which it refers (Bank of England, 2024). For a financing committee the real numbers – cash amount received, cash amount repaid, timing, all in fees and effective annual cost – are more important than just two percentages.

2.2 Commercial and rational discounting

If a bill or other short-term claim is financed prior to its due date, its face amount (F), which is the amount originally issued, may be discounted. With commercial or bank discounting, the deduction is D = Fdt, and the proceeds are F(1 − dt), where d is the rate of discount quoted. The present value of a dollar using rational discounting is the interest equivalent: PV = F/(1 + dt). The former works out the discount in terms of face value, the latter in terms of funds advanced. The methods yield cash proceeds of varying amounts at the same rate. In reality, the price of commercial paper is also influenced by the quality of the credit, the terms of the instrument, fees, and who is eligible to invest. The classroom bill in this task is a stylized representation, not proof, that there is a small travel operator who has unsecured paper markets.

2.3 Financial equivalence and amortisation

The condition of financial equivalence is the replacement payments must be equivalent in value to the original liabilities at a specified focal date and discount law. If the amounts C_k are to be paid at the end of n_k monthly periods, then PV = $\Sigma[C_k/(1 + i)\ ^n_k]$ where i is the monthly rate. If the present value of the proposed replacement schedule under the same law is that amount, then the schedule is equivalent (OpenStax, 2023b). This is the principle of debt consolidation and renegotiation, but does not ensure operational feasibility if present values are equal. A larger one-shot payment may lead to a liquidity squeeze even if it is fairly paid.

Unlike a single discount transaction, an amortizing loan does not have a single discount. The periodic instalment A = P × i/[1 − (1 + i)^−n] is a combination of principal repayment and interest on the outstanding balance. The final balance for each period is the amount of the opening balance plus the interest that accrued on the investment minus the payment. The timing of finance charges, repayments and amount outstanding are apparent in a complete schedule; where there are creditor fees or early-payment charges these are to be added separately.

3. Financial Calculations and Scenario Analysis

3.1 Design, sources and assumptions

For the numerical case, the excel workbook provided with this assignment is used. There are illustrative assumptions for each of the inputs and outputs are calculated using linked Excel formulas. There are six worksheets in the workbook: Parameters, Interest Discount, Equivalence, Amortization, Cash Forecast and TUI Evidence. The actual tables were not re-entered into Word, but rather are included as images of worksheets in Appendices A–E. The bank offers and financing cost of TUI will vary from the assumed interest rates, which are not ECB policy rates. Unless otherwise stated, all amounts are in euros (EUR).

3.2 Interest and commercial-paper comparison

At an 8.5% annual simple interest rate, an ACT/360 model yields an interest amount of €3,400 and a maturity value of €123,400 with principal of €120,000 and 120 days term. The difference is due to the different methods and one-third of a year yields €123,307.97 when applied as a percentage as an annual effective rate. The ordering is reversed over two whole years: compounded future value is €141,267 while the simple interest future value is €140,400. This illustrates the importance of asking a finance manager what the exact rate convention and cash-flow schedule is before signing up to an apparently lower borrowing rate.

Commercial discount of €100,000 face-value bill with 9% quoted bank-discount rate due after 90 days is €2,250 and net proceeds are €97,750. The present value using rational discounting is

€97,799.51, which is €49.51 higher. The commercial approach suggests that the annualized simple return on the real sum invested is around 9.21% before extra costs. Discounting may impact funding received immediately, but can speed up the collection process, and can be a transfer or retention of counterparty risk, depending on whether or not recourse is considered. Relevant decision is thus the net cash benefit less all charges and impact on future liquidity.

3.3 Equivalent debt substitution and repayments

Consider three hypothetical supplier debts: €42,000 due after 30 days, €38,000 after 90 days and €30,000 after 150 days. They are discounted to day zero in the Excel workbook at 7.2% nominal annual rate compounded semi-annually, so that the PV of these is €108,189.61. A single equivalent payment on day 120 is €110,809.62. Or two equal payments on days 120 and 210 are each €55,901.95; the workbook verifies that this is the original present value for both schemes of payment. The first one makes administration easier, but focuses risk, while the second one lowers an amount due at day 120 but gives the risk later. Both need to be agreed by the supplier and allow for a fee and the contractual change.

The calculated instalment on a separate loan over 6 months at 9% is €13,685.51. The total interest earned is €2,113.08 and the principal amount is zero (before rounding). Opening balance, period interest, instalment, principal reduction and closing balance are entered in the Excel schedule. The internal precision of a spreadsheet is maintained and euro payments are shown with 2 decimals, which means that the visible instalments might slightly differ from the adjusted final payment.

3.4 Thirteen-week cash-flow forecast

The cash model starts with an initial cash of €100,000, includes weekly cash received for bookings and cash received from suppliers/payroll, and has a minimum cash kept in the bank of €50,000. If new borrowing is not included, the minimum base-case balance is €32,000, which implies that the maximum loss to policy is €18,000. With the 20% decrease in receipts in weeks 1–8, the trough is at −€40,000 in week 8. Once this point is reached, at least €90,000 of

'contingent funding' would be needed to maintain the €50,000 target. The draw amount is a maximum shortfall and not a yearly expense to be incurred or an indication that the operator meets the credit line requirements. Other charges, such as fees, taxes, interest on drawn funds, debt repayments and customer refunds have been omitted and would need to be modelled separately.

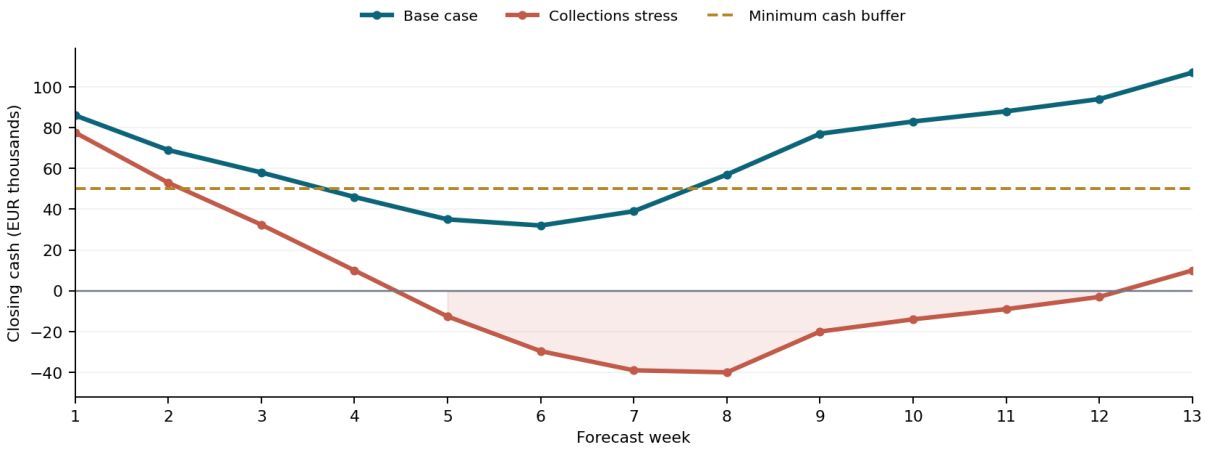


Figure 1. Illustrative 13-week cash forecast. Chart calculated from the Excel Cash Forecast worksheet. The dashed line represents the assumed €50,000 liquidity buffer.

4. Discussion and Managerial Implications

4.1 Lessons from a real travel group

A look at why seasonality and restrictions should be taken into account when managing liquidity in TUI Group. On 30 September 2025, the consolidated statements included €3,120.2 million of cash and cash equivalents of which €722.4 million was under specified restrictions, and a €4,094.3 million liability for touristic advance-payments (TUI Group, 2025b, 2025c). This restricted amount is subtracted to arrive at €2,397.8 million, but this is not a formal expression of free cash because it also takes into account committed liabilities and cash-pool locations and other obligations. TUI used cash pooling, revolving facilities and liquidity forecasting in order to manage the funding of seasonal needs (TUI Group, 2025a, 2025d). At the reporting date the main revolving facility, excluding the guarantee line, was unawareness approximately €1.78 billion, which was undrawn at the reporting date (TUI Group, 2025c).

TUI identifies the seasonal “touristic swing”, as advance and final customer receipts help to increase cash flow around the summer booking period while payments to suppliers help to reduce cash flow in winter (TUI Group, 2025d). The message to smaller companies is to not emulate TUI's size or its ability to access syndicated financing. Instead, management should be isolating information to identify funds that can be used and obligations to customers that relate to travel and future obligations to suppliers. Under the German Civil Code, insolvency protection is also relevant to package-travel organizers (PTOs) in Germany with respect to customer advances pursuant to § 651r of the German Civil Code (BGB) (Federal Ministry of Justice, n.d.).

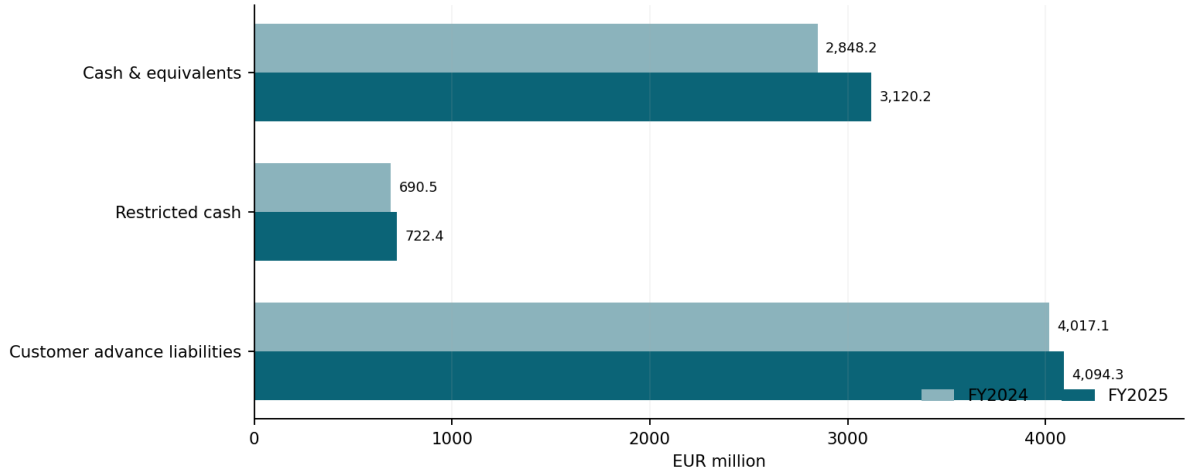


Figure 2. Selected TUI Group balance-sheet balances for FY2024 and FY2025, in EUR million. Visualised from the TUI Evidence Excel worksheet, using the published FY2025 statements.

4.2 Liquidity and refinancing roadmap

During days 1-30, the company should assume the role of a cash owner, keep reconciling the bank accounts every day, be aware of restricted/safeguarded cash, and report a 13-week rolling forecast every week. The €50,000 cash balance threshold should be raised to an escalation threshold and not a cosmetic KPI. Management should make sure to reconcile the receivables with booking systems and create weekly maturity buckets for hotel, airline, payroll, tax and refund payments. The negative side shows that at least €90,000 worth of committed facilities would be necessary on the basis of the above facts; an additional €10,000 in contingencies could be assumed, depending on the lender's evaluation and price.

Managers will need to negotiate supplier instalments and payment dates for days 31-60, and accelerate confirmed receivables collections, make controlled deposits and reduce optional expenditure prior to borrowing. Discounted receivable sales should be considered based on the application of borrowing cost and recourse clauses, and not as costless liquidity. All 120-day replacement payments should be compared to the expected cash trough. Although it may have a greater amount of total nominal payments, the two-payment equivalent option might be more operationally safe. Also, management should evaluate if the forecast would be rendered invalid by demands during peak travel season, travel disruption or cancellation.

During days 61-90, the finance lead needs to review stress assumptions, negotiate with the bank about the loan covenants that are to be observed, see if it makes sense to amortize the loan payments, and only start restructuring when creditors have agreed to it in writing, and only in the event of the NPV of the bill discounting being positive. Incorporate a separation of forecasting, bank payment authorizations and independent bank reconciliations into governance. Min cash, forecast accuracy, weeks forward, overdue receivables, max credit line (all should be monitored by management, escalating to the directors if exceeded).

4.3 Critical risks and limitations

The selection of the discount law, quotation law, and quotation basis and the focal date may greatly affect an apparent equivalent refinancing offer. Booking cancellation and refunds can have a negative impact on receipts, interest-rate and fee increases have an impact on debt-service affordability, failures by the counterparties can have a detrimental impact on the reliability of the expected cash collection. The model assumes the payment is deterministic during a week, including an opening cash that is fully accessible without changes in foreign exchange-rates, and without any tax shocks. It also reduces months to 30 days when it comes to the equivalence model. These are modelling highlights and do not apply to all German contracts. Booking data and commercial terms must be verified prior to implementation, as well as creditor agreements and insolvency protection and bank covenants.

5. Conclusion and Recommendations

Financial mathematics takes out-of-time sources of funding and makes them comparable in present value and time-based commitments. The worked exercise reveals that the proceeds and effective cost to borrow are different between nominally similar simple-interest and compound-interest rates and cash-flow is different between nominally similar simple-interest and bill-discount rates. Equivalence modelling focuses on finding the monetary fairness of replacement instalments and not on which settlement schedule the firm can afford. Capital equivalence analysis should therefore not supplant, but supplement the amortization schedule and a 13-week forecast of the cashflows.

Therefore, the most effective solutions are: A liquidity forecast based on Excel; An explicit definition of the minimum buffer; Disconnecting between restricted and usable liquidity; and negotiating agreements with suppliers and lenders in advance. The illustrative stress result suggests that a customer's deposits are not sufficient and that a priced and approved revolving credit line should be obtained, which would be sufficient for modelling the peak funding gap of the €90,000. Refinancing should be analyzed at a common focal date and fees, covenant and legal restrictions should be factored in. Real disclosures on TUI help to stress the importance of anticipating future customer commitments and cash changes throughout the season.

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Appendix A. Input assumptions and interest/discount calculations

	A	B	C
4	**Assumption**	**Value**	**Interpretation / source**
5	Loaned principal (EUR)	120000	Illustrative 120-day finance comparison
6	Annual interest rate	8.50%	Illustrative annual quote
7	Transaction days	120	Assumed actual days
8	Day-count basis	360	ACT/360 assumption; contract terms govern
9	Commercial paper face (EUR)	100000	Illustrative bill due at maturity
10	Commercial discount rate	9.00%	Illustrative quoted discount per annum
11	Paper maturity (days)	90	Illustrative issue-to-redemption days
12	Equivalence annual nominal rate	7.20%	Compounded every 30-day period, 12 periods/year
13	Period length (days)	30	Simplified 30-day months for equivalence
14	Amortising loan (EUR)	80000	Illustrative loan refinanced over six months
15	Amortisation nominal annual rate	9.00%	Monthly effective periodic rate = rate / 12
16	Loan periods	6	Six 30-day payment periods
17	Opening cash (EUR)	100000	Week 0, before weekly receipts/payments
18	Minimum cash buffer (EUR)	50000	Board policy (illustrative)
19	Stress receipts reduction	20.00%	Stress applies to first eight weeks only
20	Stress duration (weeks)	8	Illustrative collections shock

Table A1. Assumptions that are similar to those taken from the workbook Parameters sheet. Assumptions are included in blue cells; actual market rates are not guaranteed.

Appendix A (continued). Interest and discount worksheet

	A	B	C
4	**Measure**	**Calculated result**	**Financial interpretation**
5	Simple interest (120 d)	3,400.00	Accrued interest under ACT/360
6	**Simple future value (120 d)**	**123,400.00**	**Principal plus simple interest**
7	**Annual-effective FV (120 d)**	**123,307.97**	**Fractional annual effective exponent**
8	Simple less effective FV	92.03	Conventions not interchangeable
9			
10	Simple FV (2 years)	140,400.00	Simple method: no interest on interest
11	**Compound FV (2 years)**	**141,267.00**	**Annual compounding**
12	Compound minus simple	867.00	Compounding effect over two years
13			
14			
15	Commercial discount (90 d)	2,250.00	Discount deducted from bill face
16	**Commercial proceeds**	**97,750.00**	**Cash advanced against bill**
17	**Rational proceeds / PV**	**97,799.51**	**Simple-interest present value**
18	Rational discount	2,200.49	Face minus rational proceeds
19	**Rational less commercial PV**	**49.51**	**Same nominal rate; differing calculations**
20	**Commercial implied annual yield**	**9.21%**	**Simple annualised yield on funds advanced**

Table A2. The results were copied from the Interest Discount sheet in the workbook. ACT/360 is an assumption of a contract basis; all fees are not included.

Appendix B. Capital-equivalence computations

	A	B	C	D	E
4	**Obligation**	**Face (EUR)**	**Due day**	**Periods (30 d)**	**Present value (EUR)**
5	Supplier A	42,000.00	30	1	41,749.50
6	Supplier B	38,000.00	90	3	37,324.13
7	Supplier C	30,000.00	150	5	29,115.98
8					
9	**Original cash obligations, total**	**110,000.00**			**108,189.61**
10					
11					
12	**Single replacement payment (day 120)**	**110,809.62**			
13					
14	**Two equal replacement payments, days 120 and 210**	**55,901.95**			
15					
16	PV of single replacement	108,189.61			
17	PV of two replacements	108,189.61			
18	**Equivalence check (should be 0)**	**-**			

Appendix C. Excel loan amortisation schedule

	A	B	C	D	E	F
9	**Period**	**Opening balance**	**Interest expense**	**Payment**	**Principal repaid**	**Closing balance**
10	1	80,000.00	600.00	13,685.51	13,085.51	66,914.49
11	2	66,914.49	501.86	13,685.51	13,183.65	53,730.83
12	3	53,730.83	402.98	13,685.51	13,282.53	40,448.30
13	4	40,448.30	303.36	13,685.51	13,382.15	27,066.15
14	5	27,066.15	203.00	13,685.51	13,482.52	13,583.64
15	6	13,583.64	101.88	13,685.51	13,583.64	-
16						
17	**TOTAL**		**2,113.08**	**82,113.08**	**80,000.00**	**-**

Appendix D. Excel cash forecast outputs

Table D1 shows the week-by-week base forecast. Table D2 shows the stress-receipt and funding-gap columns from the same Excel worksheet (the rows retain identical week positions).

	A	B	C	D	E	F
4	Week	Receipts	Payments	Opening cash	Net flow	Base closing
5	1	42,000	56,000	100,000	(14,000)	86,000
6	2	38,000	55,000	86,000	(17,000)	69,000
7	3	48,000	59,000	69,000	(11,000)	58,000
8	4	52,000	64,000	58,000	(12,000)	46,000
9	5	58,000	69,000	46,000	(11,000)	35,000
10	6	70,000	73,000	35,000	(3,000)	32,000
11	7	82,000	75,000	32,000	7,000	39,000
12	8	95,000	77,000	39,000	18,000	57,000
13	9	102,000	82,000	57,000	20,000	77,000
14	10	93,000	87,000	77,000	6,000	83,000
15	11	88,000	83,000	83,000	5,000	88,000
16	12	86,000	80,000	88,000	6,000	94,000
17	13	92,000	79,000	94,000	13,000	107,000
18						
19	Minimum close					32,000
20	Peak liquidity facility (EUR)					

Table D1. Base-case cash-flow calculation, pasted from Cash Forecast cells A4:F20.

	G	H	I	J
4	Stress receipts	Stress closing	Base shortfall to floor	Stress shortfall to floor
5	33,600	77,600	-	-
6	30,400	53,000	-	-
7	38,400	32,400	-	17,600
8	41,600	10,000	4,000	40,000
9	46,400	(12,600)	15,000	62,600
10	56,000	(29,600)	18,000	79,600
11	65,600	(39,000)	11,000	89,000
12	76,000	(40,000)	-	90,000
13	102,000	(20,000)	-	70,000
14	93,000	(14,000)	-	64,000
15	88,000	(9,000)	-	59,000
16	86,000	(3,000)	-	53,000
17	92,000	10,000	-	40,000
18				
19		(40,000)		
20			18,000	90,000

Table D2. Stress-case output, pasted from Cash Forecast cells G4:J20. Week numbers correspond sequentially to Table D1.

Appendix E. Real-world TUI evidence sourced in Excel

	A	B	C	D
4	**Item (EUR million)**	**FY2025**	**FY2024**	**Source**
5	Cash and cash equivalents	3,120.20	2,848.20	2025 annual report, Note 22
6	Cash subject to restrictions	722.40	690.50	2025 annual report, Note 22
7	Touristic advances received	4,094.30	4,017.10	2025 balance sheet
8	Current liabilities	9,719.80	9,550.00	2025 balance sheet
9				
10	**Cash less specified restrictions**	**2,397.80**	**2,157.70**	

Table E1. FY2025 and FY2024 TUI disclosures copied from TUI Evidence worksheet. Units are EUR million, not euros.