Vinland Subsea

FX Advisory Workshop — International Finance

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Background

Vinland Subsea AS is a Stavanger-based manufacturer of remotely operated vehicles (ROVs) for the offshore energy and marine research industries. The company designs, builds, and services underwater inspection and intervention systems sold to operators worldwide. Annual revenues are approximately NOK 1.2 B, broken down as follows:

Market	Invoice currency	Share of revenue
United States	USD	60%
Japan	JPY	25%
Norway (domestic)	NOK	15%

Costs are approximately 70% NOK-denominated (engineering labor, steel, assembly). The remaining 30% are precision components sourced from Germany (EUR) and Japan (JPY).

Competitive landscape. Vinland competes primarily with OceanTech Inc. (Houston, USA) and Kaiyo Systems (Kobe, Japan) for deepwater ROV contracts. Contracts are typically denominated in the buyer's currency, and clients run competitive tenders where a 5–10% price difference can determine the outcome.

The CFO, Ingrid Haugen, has engaged your team as external FX advisors. She wants a thorough review of the company's FX exposures, the fairness of the bank's pricing, the competitive effects of recent exchange rate movements, and whether exchange rate forecasts can be used for treasury management.

Market Data

Spot FX rates (from Vinland's bank)

	Mid	**Bid**	**Ask**
NOK/USD	10.50	10.48	10.52
NOK/EUR	11.40	11.38	11.42
EUR/USD	1.10	1.0950	1.1050
NOK/JPY	0.0700	0.0698	0.0702

12-month interest rates

	12M rate
NOK (NIBOR)	4.50%
USD (SOFR)	4.00%
EUR (EURIBOR)	3.25%
JPY (TIBOR)	0.50%

Bank's 12-month forward quotes

	12M Forward
NOK/USD	10.55

All rates are annualized with simple compounding.

Historical exchange rates and price indices

Year	NOK/USD	Norway CPI	US CPI	Japan CPI
2021	8.80	100.0	100.0	100.0
2022	9.60	106.5	108.0	102.5
2023	10.20	114.2	112.3	106.0
2024	10.80	122.0	115.8	108.2
2025	10.50	127.5	118.5	110.0

CPI indices are rebased to 100 in 2021.

Tasks

Part A: FX quotes and triangular arbitrage

The bank provides Vinland with the spot quotes shown above. Ingrid wonders whether the bank's prices are internally consistent.

1. Compute the implied EUR/USD cross rate from the bank's NOK/USD and NOK/EUR mid quotes.
2. The bank's direct EUR/USD mid quote is 1.10. Is there a triangular arbitrage opportunity? Show the complete trade, step by step, starting with USD 1 000 000 and using mid-rates only.
3. Repeat the arbitrage calculation using bid-ask rates. At each step, use the rate that applies to the direction you are trading. Does the arbitrage survive transaction costs?
4. Based on your analysis, what practical advice would you give Ingrid about executing EUR/USD trades through this bank?

Part B: CIP verification

Ingrid receives a 12-month NOK/USD forward quote of 10.55 from the bank. She wants to know if this is a fair price.

1. Use covered interest rate parity (CIP) to compute the fair 12-month NOK/USD forward rate. Is the bank's quote consistent with CIP?
2. Compute the fair 12-month NOK/JPY forward rate implied by CIP.
3. Ingrid's deputy suggests: *"Japanese interest rates are near zero. We should borrow in JPY — it's much cheaper than borrowing in NOK."* Explain, using CIP, why this reasoning is flawed.
4. A second bank offers a 12-month NOK/EUR forward rate of 11.85. Compute the CIP-implied NOK/EUR forward rate. If the quote is not consistent with CIP, describe the arbitrage strategy.

Part C: Real exchange rates and competitiveness

Using the historical data above, Ingrid wants to understand how exchange rate movements have affected Vinland's competitive position versus its US rival, OceanTech.

1. Compute the **real NOK/USD exchange rate** for each year from 2021 to 2025, using:

$$e_t \;=\; S_t \times \frac{P^*_{\text{US},t}}{P_{\text{NOR},t}}$$

2. Has NOK depreciated or appreciated in **real** terms against USD over this period? Compare the real change with the nominal change.
3. Vinland prices its standard deepwater ROV at NOK 25 M. OceanTech prices an equivalent unit at USD 2.5 M. Compute Vinland's USD-equivalent price at each year's spot rate. In which years is Vinland cheaper than OceanTech, and in which years more expensive?
4. The nominal NOK/USD rate moved from 8.80 to 10.50 — a depreciation of approximately 19%. Does this overstate or understate the improvement in Vinland's competitive position? Explain using the concept of the real exchange rate and purchasing power parity.

Part D: Exchange rate predictability

A bank analyst sends Ingrid a research note:

> *"NOK is undervalued on a PPP basis. We forecast 8% NOK appreciation against USD over the next 12 months."*

Ingrid asks your team to evaluate this claim.

1. According to uncovered interest rate parity (UIP), what is the expected change in the NOK/USD exchange rate over the next year?
2. The Fama (1984) regression estimated on NOK/USD data yields:

$$\Delta s_{t\to t+1} \;=\; 0.01 \;-\; 0.80 \times (f_t - s_t)$$

   where Δs is the log change in the spot rate and $(f - s)$ is the log forward premium. Interpret the slope coefficient. What does it tell us about the validity of UIP?

3. A colleague suggests: *"Norwegian rates are higher than US rates. Just invest in NOK deposits — the carry is free money."* Evaluate this claim using the Fama regression results and the concept of currency risk premia.

4. Based on your analysis, what should Ingrid conclude about (a) using the bank analyst's forecast for treasury decisions, and (b) the general predictability of exchange rates?

All data in this exercise is fictional but calibrated to realistic market conditions.