

Currency markets: Section 7

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Pset 4 review

1. Yes, there is an arbitrage opportunity.

2.

a. Yes, there is a violation of CIP.

b. See “Investing in forward markets” example in Section 5 slides.

c. Net profit = $1.067 - 1.065 = 0.002$ USD per unit of USD invested.

d. $\frac{F_t - S_t}{S_t} = \frac{1.45 - 1.42}{1.42} \approx 0.021127$ (forward premium) $> 0.02 = i_t^{\$} - i_t^{\text{€}}$.

e. $F_t = S_t \frac{1 + i_t^{\$}}{1 + i_t^{\text{€}}} = 1.42 \cdot \frac{1.065}{1.045} = 1.447$.

Pset 4 review

3. e) i and iv

Domestic currency to foreign currency strategy profits if

$$Profit = \frac{F_b}{S_a}(1 + i_b^*) - (1 + i_a) > 0$$

To prevent this,

$$\frac{F_b}{S_a}(1 + i_b^*) - (1 + i_a) \leq 0 \Rightarrow \frac{F_b}{S_a}(1 + i_b^*) \leq 1 + i_a.$$

Similarly, foreign currency to domestic currency strategy profits if

$$Profit = \frac{S_b}{F_a}(1 + i_b) - (1 + i_a^*) > 0$$

To prevent this,

$$\frac{S_b}{F_a}(1 + i_b) - (1 + i_a^*) \leq 0 \Rightarrow \frac{S_b}{F_a}(1 + i_b) \leq 1 + i_a^*.$$

4.

a. Net cashflows

US Company A: (-4.1% in €), $\text{€} - 2.05 \text{ mil} \times 5 = \text{€} - 10.25 \text{ mil}$

German Company X: (-6.15% in \$), $\text{\$} - 3.6285 \text{ mil} \times 5 = \text{\$} - 18.1425 \text{ mil}$

Swap bank: (0.15% in \$, 0.10% in €),
 $(\$88,500 + \text{€}50,000) \times 5 = \$737,500$

b. Savings/earnings

US Company A saved (0.9% per year) $\text{€}2.25 \text{ mil}$

German Company X saved (0.85% per year) $\text{\$}2.5075 \text{ mil}$

Swap bank earned (0.15% in \$, 0.10% in €) $\text{\$}737,500$

Reasons for currency hedging

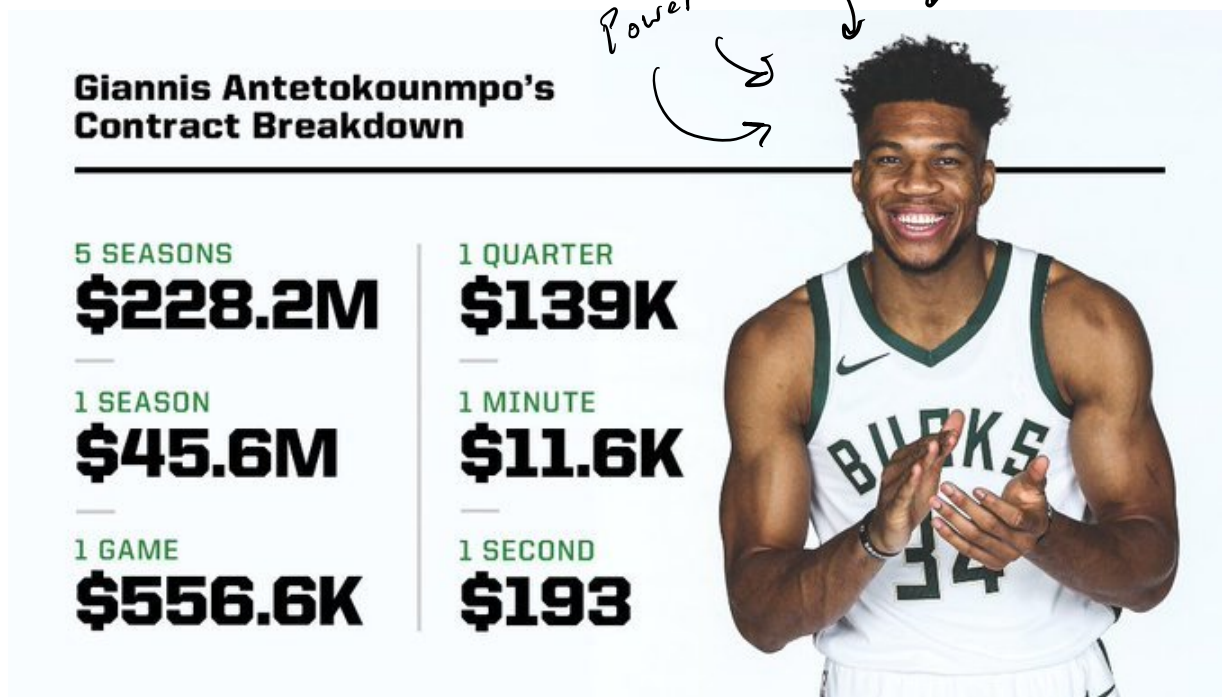
- Information asymmetry: firm vs. shareholders
- Differential transaction costs: firm vs. shareholders
- Default costs: currency hedging decreases probability of bankruptcy.
- Progressive corporate taxes: stable pre-tax earnings → lower corporate taxes relative to volatile pre-tax earnings.¹

¹Mackay and Moeller (2007), “The Value of Corporate Risk Management”, The Journal of Finance, 62, pg. 1379-1419.

Different way to hedge currencies

We'll start with forward contracts.

Forward contracts



Currency hedging with forward contracts

Suppose that EuroLeague Basketball wants to form a team in the UK. NBA built a new basketball facility to develop athletes in UK and billed EuroLeague £10 million payable in one year.

The NBA could wait a year to receive its payment and exchange £10 million at the future spot rate, but it is worried about exchange rate risk.

Instead, the NBA sets up a forward contract with a bank and sells its pounds forward for a £10 million delivery in one year at the one-year forward rate of \$1.3639/£. In one year, the NBA receives £10 million from EuroLeague, hands the £10 million to the bank, and receives \$13.639 million independent of the spot rate. The NBA's net pound exposure is zero.

Currency hedging in money markets

Now re-consider our first example, and suppose that $i^{\$} = 1.25\%$ and $i^{\pounds} = 1\%$ with the current spot rate $S_0 = \$1.3646/\pounds$.

The one year discounted $\pounds 10,000,000$ payment is $\pounds 9,990,990.10$. An example of money market hedging would be:

- Borrow $\pounds 9,990,990.10$ for one year.
- Convert $\pounds 9,990,990.10$ to $\$13,510,891.09$ at S_0 .
- Invest $\$13,510,891.09$ at $i^{\$}$ in the US.
- After a year, collect $\pounds 10$ million from EuroLeague Basketball and repay borrowed $\pounds 9,990,990.10$.
- Receive $\$13,510,891.09 \cdot 1.0125 = \underline{\underline{\$13,679,777.23}}$.

Notice all actions were done at $t = 0$. No exchange rate exposure.

Hedging through invoice currency

- The NBA could also invoice the EuroLeague in \$ which would eliminate (shift) exchange rate risk for the NBA.
- The NBA and EuroLeague could share the exchange rate risk by invoicing half in \$ and half in £.

Currency swaps as a sequence of forwards

Now suppose the UK and NBA want to form a basketball team in UK to compete in the EuroLeague. UK willing to give NBA £100 million ~~loan~~ with interest rate subsidized in pounds (10%). *3 years loan*

NBA accepts but does not want £s liability because NBA does not want exchange rate risk.

NBA goes to bank with one-to-one spot and exchanges £s for \$s.

NBA needs to buy £s forward.

Currency swaps as a sequence of forwards

If $S_0 = \$1/£$, $F_1 = \$1.1/£$, $F_2 = \$1.2/£$, $F_3 = \$1.3/£$ } today

		$t = 0$		$t = 1$		$t = 2$		$t = 3$	
UK government		-£100			+£10		+£10		+£110
NBA		+£100	-£100 +\$100	-\$11 +£10	-£10	-\$12 +£10	-£10	-\$143 +£110	-£110
Bank			+£100 -\$100	+£11 -£10		+£12 -£10		+£143 -£110	
			S_0	F_1		F_2		F_3	

No $£$ exchange rate risk for NBA
Everything decided at $t=0$

Currency hedging with recurrent exposures

Suppose the NBA now has a EuroLeague Basketball team in UK. The NBA now has a recurrent revenue stream in £. It plans to recoup 1% of the UK team's annual profits and re-invest the rest of the profits back into the UK team. The NBA's analysts predict profits of £10 million annually for the next five years.

The NBA can eliminate exchange rate risk today by (once again) setting up a sequence of forward contracts at F_1, F_2, F_3, F_4, F_5 .

Pset 5 hints

1. Assume parity conditions hold (don't use approximations).
2.
 - b. Demonstrate the relationship with a regression.
3. Recall Section 6 discussion of real exchange rates.

q

Pset 5 hints



- Finance
- Globalisation
- Health
- Industry and Services
- Information and Communication Technology
- International Trade and Balance of Payments
- Labour
- National Accounts
- Monthly Economic Indicators
- Productivity
- Prices and Purchasing Power Parities
 - Consumer and Producer Price Indices
 - Consumer price indices (CPIs) - Complete database
 - Consumer price indices (CPIs) - Complete database
 - Consumer prices - Annual inflation
 - Consumer prices - Annual inflation, Food and non-food
 - Consumer prices - Annual inflation, Food and non-alcoholic beverages
 - Consumer prices - Annual inflation, Energy
 - National CPIs and weights by COICOP by country
 - Contribution to annual inflation by COICOP by country - OECD estimates

Consumer price indices (CPIs) - Complete database

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Country [53 / 54] Subject [98 / 104] Measure [7 / 7] Time & Frequency [68]

Measure: Percentage change on the same period of the previous year

Frequency: Annual Quarterly

Time: 2015 2016 2017 2018 2019 2020 Q4-2016 Q1-2017 Q2-2017 Q3-2017 Q4-2017 Q1-2018 Q2-2018 Q3-2018 Q4-2018 Q1-2019 Q2-2019 Q3-2019 Q4-2019 Q1-2020 Q2-2020 Q3-2020 Q4-2020 Q1-2021 Q2-2021 Oct-2017 Nov-2017

Country Unit

1 Australia Percentage 1.5 1.3 1.9 1.9 1.6 0.8 1.5 2.1 1.9 1.8 1.1 1.9 2.1 1.9 1.8 1.3 1.6 1.7 1.8 2.2 -0.3 0.7 0.9 1.1 3.8

2 Austria Percentage 0.9 0.9 2.1 2.0 1.5 1.4 1.3 2.0 1.9 2.1 2.2 1.8 1.9 2.1 2.1 1.7 1.7 1.4 1.3 1.9 1.0 1.4 1.2 1.3 2.5 2.2 2.3

3 Belgium Percentage 0.6 2.0 2.1 2.1 1.4 0.7 1.9 2.6 1.9 1.9 2.1 1.5 1.8 2.3 2.6 2.2 1.9 1.2 0.5 1.0 0.5 0.8 0.6 0.5 1.4 2.0 2.1

4 Canada Percentage 1.1 1.4 1.6 2.3 1.9 0.7 1.4 1.9 1.3 1.4 1.8 2.1 2.3 2.7 2.0 1.6 2.1 1.9 2.1 1.8 0.0 0.3 0.8 1.4 3.3 1.4 2.1

5 Chile Percentage 4.3 3.8 2.2 2.4 2.6 3.0 2.8 2.8 3.3 1.7 2.0 2.0 2.2 2.8 2.8 2.3 2.6 2.5 2.8 3.7 2.9 2.7 2.9 3.6 1.9 1.9

6 Colombia Percentage 5.0 7.5 4.3 3.2 3.5 2.5 6.1 5.1 4.3 3.7 4.1 3.4 3.2 3.1 3.3 3.1 3.3 3.8 3.8 3.7 2.8 1.9 1.6 1.6 3.0 4.0 4.1

7 (can change to index) Costa Rica Percentage 0.8 0.0 1.6 2.2 2.1 0.7 3.6 1.1 1.7 1.2 2.5 2.4 2.2 2.2 2.1 1.5 2.3 2.8 1.8 1.8 0.6 0.0 0.5 0.6 1.5 2.3 2.5

Czech Republic Percentage 1.3 0.7 2.5 2.1 2.8 3.2 1.5 2.4 2.2 2.5 2.6 1.9 2.3 2.4 2.1 2.7 2.8 2.8 3.0 3.6 3.1 3.3 2.6 2.2 2.9 2.9 2.6

Denmark Percentage 0.5 0.3 1.1 0.8 0.8 0.4 0.4 1.0 0.8 1.5 1.3 0.6 1.0 0.9 0.8 1.2 0.7 0.4 0.7 0.6 0.1 0.5 0.5 0.7 1.6 1.5 1.3

Estonia Percentage -0.5 0.1 3.4 3.4 2.3 -0.4 1.3 3.0 3.1 3.7 3.8 3.1 3.3 3.6 3.7 2.3 2.9 2.2 1.7 1.5 -1.2 -0.9 -1.1 0.7 3.1 3.8 4.2

Exam

- 24 hour take-home exam.
- If you've had submission issues before, use this last homework as practice for correctly submitting your work.
- Equity and currency review in next week's section.
- Equity: review materials and homework – make sure you understand the assignments.
- Currency: updates coming soon.