Summary

-Econometric and Integration: Multinationals and Finance-

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Multinationals and finance

Chapter 3. International financial markets

Multinational company (MNC):

- Operates in more than one country
- Owned by foreign shareholders
- Account for 40% of jobs in the private sector
- 80% of international goods trade
- The higher the share value, the better the performance
- Rely on domestic and international financial markets
- Reduced reliance on loans after 2008 crisis

The foreign exchange market:

- Spot market:
  - Allows a MNC to exchange immediately, on-the-spot
  - Trading activity determines its liquidity
- Forward market: exchange in the future.
  - 30, 60, 90, 180, 360 days
  - Obliged
  - Large amounts of money
- Futures market: exchange in the future
  - Standardized agreements
  - Obliged
- Options market: gives access to currency in the future, option to purchase or sell currency in the future. It is a right.
  - American options: exercised whenever vs. European option: exercise at expiry date
  - Standardized agreement
  - Costly, premium
- Money market: financial institutions that receive deposits and offer loans in various currencies.
- Credit market: short-term funds.
  - Facilitate banks' maturity matching of assets and liabilities
- Bond market: medium-term funds or debt
  - Issued by companies and government
  - Foreign bonds
- Stock market: long-term funds through issuance of shares
  - Access to international markets by listing at exchanges
  - Yankee stock offerings: non-US firms listed in the NY stock exchange

How is foreign currency priced?

- Direct method: value of foreign currency in domestic currency. Value of pound in euros. If euro is home currency, 1 GBP is worth 1.25 euro → 1.25 EUR : 1 GBP. Fixed foreign, domestic variable. Lower exchange rate implies an appreciation of the euro.
- Indirect method: how much foreign currency for 1 unit of home currency. 0.8 GBP : 1 EUR. Lower exchange rate, domestic currency is depreciating.

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Bid/Ask spread:

- Bid: purchased, what buyer offers to pay for the currency
- Ask: rate at which it is sold, what the seller asks you to pay
- Look at seller/buyer's perspective
- Smaller spread → better liquidity

Chapter 5. Currency derivatives

Forward contract:

- Agreement between two parties (buyer and seller) for exchanging currency.
- Amount, price and data is determined.
- Bounded contract.
- The forward premium/discount reflects the difference between home and foreign interest rates. It prevents arbitrage, not able to generate a riskless profit.
- F = forward rate, S = spot rate, F = S(1 + p)

	F > S	F < S
Receivables	Premium	Discount
Payables	Discount	Premium

- Unlimited downward potential: no limit on losses (it is actually 0)
- Unlimited upward potential: no limit on profits.
- Linear functions.

Futures contract:

- Specify a stand volume of a particular currency to be exchanged on a specific settlement data at a specified exchange rate.
- Can be used for speculation: buy cheap and sell expensive.
- Used by MNCs to hedge receivables and payables.
- Mark to market: margin account. As buyer, you want S > K (exercise price). As seller, you want S < K.

Daily settlement for a futures contract on the Dollar £s per $1

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
MARKET price of the Futures contract	0.66	0.68	0.71	0.63	0.67	0.68
seller (payments) and receipts		(0.02)	(0.03)	0.08	(0.04)	(0.01)
buyer (payments) and receipts		0.02	0.03	(0.08)	0.04	0.01

Example of default - the reason for daily settlement

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
MARKET price of the Futures contract	0.66	0.68	0.71	0.63	0.67	0.68
seller 1 (payments) and receipts		(0.02)	(0.03)	*		
replacement seller 2 (payments) and receipts				0.08	(0.04)	(0.01)
buyer (payments) and receipts		0.02	0.03	(0.08)	0.04	0.01

* then defaults, remember this is per unit so the total payment may be large

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Comparison forwards and futures:

	Forwards	Futures
Contract size	customized	standardized
Delivery date	customized	standardized
Participants	Banks, brokers, MNCs	Banks, brokers, MNC
Market place	telephone network	central exchange
Regulation	self-regulating	regulated
Liquidation	settled at delivery	settled by offset
Transaction costs	bid/ask spread	brokerage fees

Currency option:

- Right to buy or sell
- Not an obligation
- Call option: right to buy
- Put option: right to sell

Call option:
Buyer: S > K. Buy cheaper than on the market. If you do not exercise the option, when S < K, you lose the premium paid. The seller receives that premium.
Seller: S < K. Sell more expensive than on the market. If you do not exercise the option, since S > K, you pay the premium.

Put option:
Buyer: S < K, exercise. Sell more expensive than on market. S > K, do not exercise. Lose premium.
Seller: S > K, exercise.

Pay always the premium: -p

Upper left: buyer call option.
Upper right: sell call option.
Lower left: buyer put option.
Lower right: sell put option

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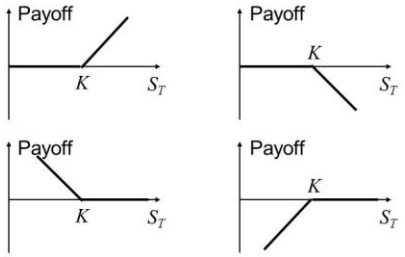
Payoffs from Options

What is the Option Position in Each Case?

K = Strike price, S_T = Price of asset at maturity



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Chapter 7. International arbitrage and interest rate parity

Arbitrage = make a risk-free profit from a difference in quoted price. There are 3 forms:

- **Locational arbitrage**. Buy the currency at the cheap location and sell it at the higher price location, occurs at banks. To do this, the bid price of one bank must be higher than the ask price of another bank. You buy at ask price and sell at bid price.
  There may be a mis-alignment of prices because: price are not accurate, regulations, not covered transactions or no incorporated risk.
  High demand for one currency will raise the ask price for one bank, and lower the bid price for the other. Arbitrage will no longer occur.
  The threat of locational arbitrage ensure that quoted exchange rates are similar across banks in similar locations.
- **Triangular arbitrage**. Differences is the cross exchange rate between two currencies. Bid/ask spreads prevent triangular arbitrage.
  The threat of triangular arbitrage ensures that exchanging money via another currency is in line with direct conversion.
- **Covered interest arbitrage**. Capitalizing on interest rate differences between two countries while covering exchange rate risk (hedging). Investment and period of time is required. Profit due to the mis-alignment of exchange rates.
  The threat of covered interest arbitrage ensures that the forward exchange rate is aligned with interest rates and the spot rate.

Interest rate parity (IRP): interest and exchange rates adjust such that covered interest arbitrage is not feasible. The forward rate offsets the interest rate differential. What is gained on interest rates is lost on exchange rates when converting back.

i_h = interest in home, i_f = interest in foreign
R = return from covered interest arbitrage, made up of i_f
p = the value of the foreign currency, the forward premium or discount. Same amount as interest differential.

$i_f = i_h$ according to IRP, thus R = i_h

$$forward\ premium\ or\ discount\ of\ foreign\ currency, p = \frac{1+ih}{1+if} - 1$$

$$Derived\ from: F = S(1+p)$$

Approximate form: p = i_h - i_f

$i_f > i_h$, forward discount on foreign currency.
$i_f < i_h$, forward premium on foreign currency.

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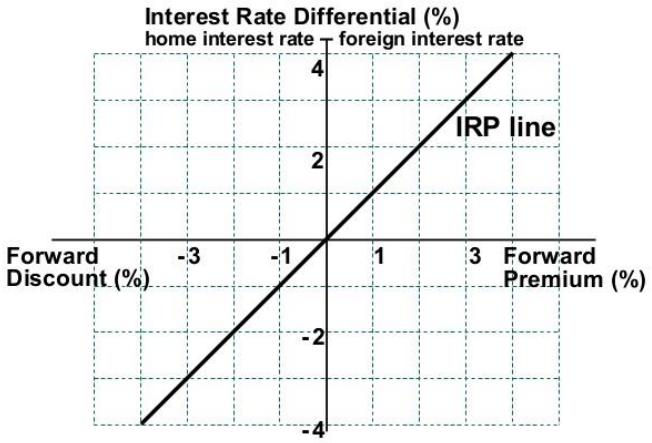
Graphic Analysis of Interest Rate Parity



On the IRP line, there is no room for covered interest arbitrage.
Off the IRP line, there is room for it.

There are some considerations when assessing interest rate parity. If IRP does not hold, covered interest arbitrage still may not be worthwhile due to:

- Transaction costs. There is a larger zone for where covered interest arbitrage is not profitable.
- Political risk. There is no guarantee that the foreign government will allow the funds to be reconverted.
- Differential tax laws. Covered interest arbitrage may not be feasible when considering after-tax returns.
- Changes in forward premium. Governments may protect their currency by buying it on the forward market. This may affect the interest rates.

Chapter 8. Relationships among inflation, interest rates and exchange rates

Purchasing power parity (PPP) bases its predictions of exchange rate movement on changing patterns of trade due to different inflation rates between countries. There are two forms:

- **Absolute form of PPP**. When there is no trade barriers and transport costs, consumers demand the goods where the price is the lowest. This shift in demand leads to a convergence of prices. The price of two goods should be equal.
- **Relative form of PPP**. Imperfections such as transport costs exist. The difference in prices in % should be constant. The exchange rate offsets the differential in inflation rates in the two countries. Price rise with 4%, currency depreciates with 4%. Thus, relative prices are undisturbed by inflation differences.

The foreign price index from the home consumer's perspective becomes: $pf(1+If)(1+ef)$

I is inflation rate, ef is the percentage change in the value of the foreign currency

Under conditions of PPP: new price index foreign = new price index home currency

$$pf(1+If)(1+ef) = ph\,(1+Ih)$$
$$(1+ef) = \frac{ph(1+Ih)}{pf(1+If)}$$
$$ef = \frac{ph(1+Ih)}{pf(1+If)} - 1$$

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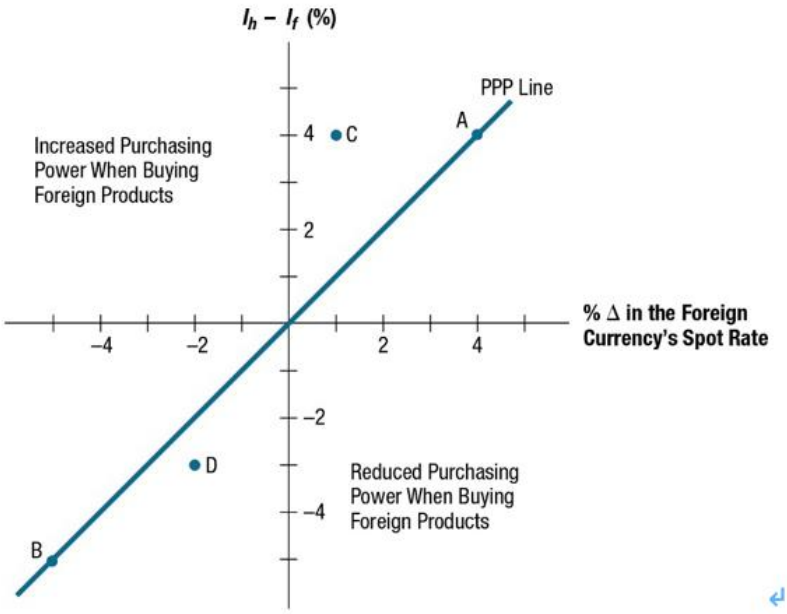
$ph = pf, price\ indexes\ are\ assumed\ equal$
$ef = \frac{(1+Ih)}{(1+If)} - 1$

Notice that if Ih > If, ef is positive → foreign currency appreciates. Appreciation of foreign currency offsets the lower inflation. Vice versa.

This formula can also be written in approximate terms:

$ef = Ih - If$
$Ih = If + ef$

On the PPP line (A & B), the PPP formula holds and there has been no change in the relative price of imported goods with home priced goods. There are also points of purchasing power disparity (C &D), the exchange rate does not offset the difference in inflation rates of the two countries. This may only occur in the short run. Over time, there is upward pressure on the foreign currency will cause point C to move toward the PPP line.



PPP may not occur in real life because that there is an unspecified period of change. Should we use numbers of the past of inflation expectations? The measurement is problematic and the ceteris paribus assumptions should be taken into account.

The relationship between inflation differential and the exchange rate movement is not as simple as PPP suggests. There are confounding effects which affect the percentage change on the spot rate, e:

$e = f(\Delta\text{INF}, \Delta\text{INT}, \Delta\text{INC}, \Delta\text{GC}, \Delta\text{EXP})$

The real exchange rate:

The exchange rate adjusted for inflationary effects in the two countries. Expressed as an index. We can make a formula for a change in the real purchasing power of a currency:

$\Delta\text{Rh} = \text{Ih} - \text{If} - \text{ef}\ \text{or}\ \Delta\text{Rh} = \text{eh} + (\text{Ih} - \text{If})\ \ since\ eh = -ef$

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Higher inflation in the home currency can be fully offset by a fall in the home currency (depreciation). Higher inflation in the foreign currency can be fully offset by an increase in the home currency. Notice the 'can' , it is not necessary to fully offset this inflation with a devalue.

When the nominal exchange rate changes, it should be the case that the real exchange rate remains constant because the nominal change is only offsetting the change in inflation rates. Result: no change in PPP and no change in the real exchange rate. A problem is that the real exchange rate moves as a random walk. In addition, PPP has an unrealistic assumption that there is a hidden mean to which the currency reverts to after a deviation.

Another approach to examine the effect of prices on the exchange rate is to take a particular price and see if it has an effect on the currency. Commodity prices can have an influence. There is a relationship between national real exchange rate and the real commodity price in the long run.

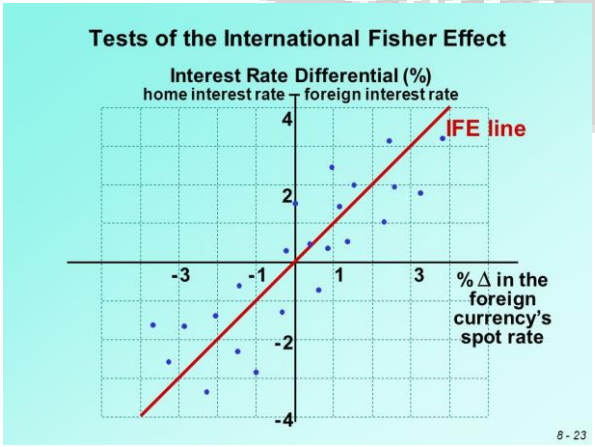
International Fisher effect (IFE): it uses the interest rate instead in inflation to explain why exchange rates over time. Referred to as uncovered interest arbitrage. High inflation is accompanied by high interest rates. If inflation is 10%, an investor will want at least 10% return so that the value of the investment has the same buying power.
The theory suggests that foreign currency with high interest rates will depreciate. The difference in inflation is the same as the difference in interest rates.
$interest\ rate = time\ preference + risk + inflation$
Real interest rate = nominal rate – inflation.
Where the higher interest rate is, there may be an upward pressure on the currency. This is only the case is this is unexpected.
The possibilities are: invest at home or:
i) convert investment to foreign currency
ii) invest in foreign treasury bills, bonds etc.
iii) convert back to the home currency.

Derivation of the IFE:

$$ef = \frac{(1+ih)}{(1+if)} - 1$$

Approximate form: ef = ih - if

The IFE line:



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Points on the IFE line: exchange rate adjustments offset the differential in interest rates. Same yield in home and foreign.

Points above the IFE line: higher return from investing in home. (ih – if) < ef or ih > (ef + if) .

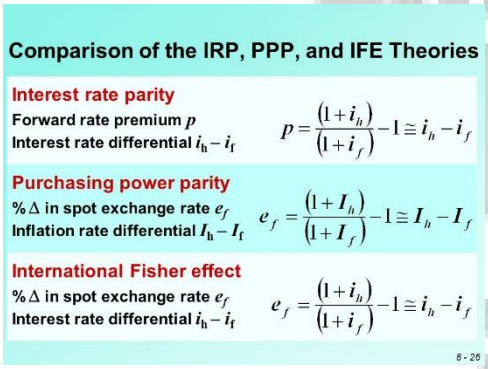
Points below the IFE line: higher return from investing in foreign. (ih - if) > ef or ih < (ef + if).

A risk premium can be included when evaluating IFE.

$$ef + pf = ih - if$$

Pf represent the extra risk of investing in a particular country.

Comparison of IRP, PPP and IFE theories:



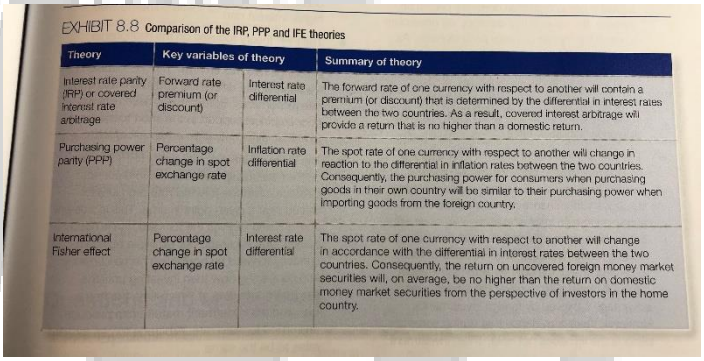


EXHIBIT 8.8 Comparison of the IRP, PPP and IFE theories

Theory	Key variables of theory		Summary of theory
Interest rate parity (IRP) or covered interest rate arbitrage	Forward rate premium (or discount)	Interest rate differential	The forward rate of one currency with respect to another will contain a premium (or discount) that is determined by the differential in interest rates between the two countries. As a result, covered interest arbitrage will provide a return that is no higher than a domestic return.
Purchasing power parity (PPP)	Percentage change in spot exchange rate	Inflation rate differential	The spot rate of one currency with respect to another will change in reaction to the differential in inflation rates between the two countries. Consequently, the purchasing power for consumers when purchasing goods in their own country will be similar to their purchasing power when importing goods from the foreign country.
International Fisher effect	Percentage change in spot exchange rate	Interest rate differential	The spot rate of one currency with respect to another will change in accordance with the differential in interest rates between the two countries. Consequently, the return on uncovered foreign money market securities will, on average, be no higher than the return on domestic money market securities from the perspective of investors in the home country.

Chapter 9. Forecasting exchange rates

Reasons why firms forecast exchange rates:

- Hedging decisions, may be determined by forecasts of foreign currency values.
- Short-term financing decision. An ideal currency: a low interest rate and a decline in value over the financing period and thus cheaper to repay.
- Short-term investment decision. Ideal currency for deposits will have a high interest rate and strengthen in value over the investment period.
- Capital budgeting decision. Cash flows should be measured in the parent's local currency.
- Earnings assessment. Should foreign subsidiaries invest in a foreign currency or remit back to the home currency. Prefer to convert to home if the foreign currency weakens.
- Long-term financing decision. When firms issue bonds, they may consider denominating the bonds in the foreign currencies. Prefer the currency borrowed to depreciate over time.

Market efficiency:

The efficiency of the foreign exchange market has implications for the approach to predicting movements as the **efficient markets hypothesis (EMH)** attempts to answer: why do prices change? The idea behind EMH is that prices change as a result of news. News = actual information – expected information. Any news can be positive or negative, it depends on the values of expectations.

Dividing EMH into three forms:

1. Weak-form efficient: prices reflect estimates of the future value of the currency. historical information has no role to play in explaining a change in price. Such information is already included in the current expectation and thus price. This has some implications:
   * Technical forecasting (attempt to find patterns in exchange rates) has no role in estimating

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changes in the exchange rate.
* The movement of the exchange rate should be random as there is no pattern.
* If the movement is random, the changes should be normally distributed.

2. Semi-strong efficient: exchange rate reacts in an immediate and unbiased way to all publicly available information. Everyone has access to information. Price movements are reactions to new information available to all.
3. Strong-form efficient:
   * All relevant and public information is already reflected in today's exchange rates.
   * Possibility of insider trading

Direct semi-strong efficiency tests show that price react to information almost immediately. An unusual movement in a price will occur before an announcement. This may be because of insider trading or good anticipation.
In reality, most markets are semi-strong: react quickly to published information and don't react to the information before it becomes public.

Implications about the market efficiency:

- It is the most fundamental in finance.
- The way how information is disclosed does not matter.
- It does not mean that the estimate is accurate.
- The definition of information as news does much to explain why academic models can be inaccurate. It is based on expectations.

1. Technical forecasting:

The use of historical exchange rate data to predict future values based on patterns in past prices. However, prices move in reaction to future information and not past price movements. Technical factors that cause an adjustment in a currency's value:

- Technical factors overwhelmed economic news.
- Technical factors triggered sales of pounds.
- Technical factors indicated that euros has been recently oversold, triggering purchases of euros.

Speculators may capitalize on day-to-day exchange rate movements, such as the above examples.

2. Fundamental forecasting:

Based on the fundamental relationships between economic variables and exchange rates. This may be due to differences in inflation, home interest and foreign interest, home income level and foreign income level, change in government controls and change in expectations of future exchange rates.
* Use of sensitivity analysis for fundamental forecasting: the actual value of a factor may be used for the exchange rate if the factor has a lagged impact. Sensitivity analysis considers more than one possible outcome for the factors exhibiting uncertainty.
* Use of PPP for fundamental forecasting. The change in the foreign currency value should reflect the differential between the home inflation and the foreign inflation rate. However, this is not always accurate since:
- The timing of the impact of inflation fluctuations on changing trade patterns, and thus on exchange rates, is not known with certainty.
- Data used to measure relative prices of two countries may be inaccurate.

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- Barriers to trade can disrupt trade patterns that should emerge in accordance with PPP theory.
- Other factors, such as the interest rate differential between two countries, can also affect exchange rtes.

Limitations of fundamental forecasting:

- The precise timing of the impact of some factors on a currency's value is not known. It may have an impact quarters later.
- Some factors exhibit an immediate impact on exchange rates. However, these values may be inaccurate.
- Some factors cannot be easily quantified.
- Coefficients derived from the regression analysis will not necessarily remain constant over time.

3. Market-based forecasting:

Developing forecasts from market indicators, based on the spot rate or the forward rate.

1. Use of the spot rate. It is the same as forecasting that there will be no change in the exchange rate. The current value already represents the market's expectations.
2. Use of the forward rate. It should be a better estimate since it includes time.

Long-term forecasting with forward rates: covered interest arbitrage is not possible. It tends to change from expectations over longer periods of time, so it is less accurate than short term forward rates. Over a very short term horizon, the spot rate may be more useful than the forward rate.

4. Mixed forecasting:

the use of technical, fundamental and market-based forecasting. The techniques are assigned in weights so that they equal 100%.

Measurement of forecast error: shows if the forecasting procedure was satisfactory.

$$absolute\ forecast\ error\ as\ a\ fraction\ of\ the\ realized\ value = \frac{(Forecasted\ value - Realized\ value)}{Realized\ value}$$

EMH states that the best forecast of a future exchange rate is the current one, the spot rate, since all information is included in the current price.

5. Volatility:

$$\sigma longterm = \sigma shortterm * \sqrt{time}$$

$$Confidence\ intervals:$$
$$Upper\ bound = spot\ rate * (1 + (t\ value * \sigma))$$
$$Lowerr\ bound = spot\ rate * (1 - (t\ value * \sigma))$$

Statistical test of forecasting:

$$\frac{St-(St-1)}{St} = ef = a0 + a1\frac{(Ft-1,t)-St}{St} + \mu t$$
$$acutal\ change = change\ predicted\ by\ forward\ rate$$

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Should MNCs make exchange rate forecasts?

- Yes, MNC can't beat the market by speculating and should hedge the risk.
- No, making regular forecasts can lead to profits or losses.

Chapter 10. Measuring exposure to exchange rate fluctuations

Arguments for exchange rate risk irrelevance:

- According to PPP, exchange rate movements are a response to differential in price changes between countries. E effect is offset by the change in prices. In reality PPP does not always hold.
- Investors in MNCs can hedge exchange rate risk on their own. Thus, companies need not concern themselves with currency risk.
- If a MNC is well diversified across countries, its value will not be affected by exchange rate movements because of offsetting effects.
- Creditors who provide loans to MNCs can experience large losses if the MNCs experience financial problems. Thus low exposure to exchange rate risk is preferred.

If a firm is highly exposed to exchange rate fluctuations, it can consider techniques to reduce its exposure:

1. **Transaction exposure**. The degree to which the value of future cash transactions can be affected by exchange rate fluctuations. Net amount in currency inflows or outflows. Short-term.
   * Average expected cash flow:
   $$CF = Cf\ x * Sx + CFy * S\ y$$
   * Measuring the potential impact of the currency exposure:
   $$Volatility: \sigma\rho = \sqrt{\sigma_x^2 + \ \sigma_y^2 + 2\sigma_x^2\sigma_y^2 CORRxy}$$
   * The standard deviation measures the degree of movement of each currency. It is easy to underestimate the variability due to the peso effect: quiet periods and then suddenly a collapse.
   * Measurement of currency correlation: the degree to which two currencies move in relation to each other.
   * Taking into account the correlation between the movements of exchange rates is essential in estimating the overall risk. This is called multicurrency exposure.
   * Confidence interval with two currencies when normally distributed: CFx ± 1.96 * st.dev x
   * Currency correlations over time.

Another method for assessing exposure is termed value-at-risk (VAR). It incorporates volatility and correlations to determine the potential maximum one-day loss of the value of positions held by an MNC. It relies on the outcomes being normally distributed.
$$Maximum\ 1day\ loss = E(et) - (left\ tail\ of\ distribution * st.dev.\sigma\ )$$

2. **Economic exposure.** The degree to which a firm's future cash flows can be influenced by exchange rate fluctuations. All types of future transactions that cause transaction exposure,

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also cause economic exposure because these transactions represent cash flows that can be influenced by exchange rate fluctuations.
Economic exposure to home currency appreciation and depreciation:

EXHIBIT 10.9 Economic exposure to exchange rate fluctuations

Transactions that influence a firm's cash inflows in home currency terms	Impact of home currency gain in value	Impact of a fall in value of the home currency
Home sales when affected by foreign competition in home markets	Decrease	Increase
Firm's exports denominated in home currency	Decrease	Increase
Firm's exports denominated in foreign currency	Decrease	Increase
Interest received from foreign investments	Decrease	Increase
Transactions that influence a firm's cash outflows in its home currency		
Firm's imported supplies denominated in home currency	No change	No change
Firm's imported supplies denominated in foreign currency	Decrease	Increase
Interest owed on foreign funds borrowed	Decrease	Increase

* How to measure economic exposure?
1. Calculate the volume changes in the currency where they occur – such change is typically as a result of a change in the level of sales. You may need to convert back to original currency.
2. Convert home currency at the exchange rate for the choses scenario.

3. **Translation exposure**. The exposure of the MNC's consolidated financial statements to exchange rate fluctuations. Subsidiaries are measured in local currency, but have to be translated to currency of MNC's parent. Since exchange rates change over time, the translation is affected by exchange rate movements.
Translation exposure is dependent on:
* Proportion of its business conducted by foreign subsidiaries.
* Locations of foreign subsidiaries, the volatility of the currency in relation to the home currency.
* Accounting methods.

Chapter 11. Managing transaction exposure

Transaction exposure exists when the anticipated future cash transactions of a firm are affected by exchange rate fluctuations. A company faces 3 tasks:

1. Identifying net transaction exposure on a currency-by-currency basis. It is the difference between expected inflows and outflows.
2. Decide whether to hedge this exposure. This decision is based on the firm's degree of risk aversion.
3. Choose among hedging techniques available:

- Future Hedge:
Purchasing currency futures: you receive a specified amount in a specified currency for a stated price on the stated date. It locks in the amount of home currency needed to make the payment.

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Selling currency futures: you sell a specified amount in a specified currency for a stated price on the stated date. It locks in the value of its future receivables from the fluctuations of the spot rate.

- Forward hedge: same as futures, only forwards are used for large transactions. You can specify the exact number. Between the firm and a commercial bank.
  Expected cost of hedging receivables, ECHr = (receivalbes when not hedged – receivables when hedged) * Probability of given exchange rate.
- Hedging techniques can backfire when payables depreciate or receivables appreciate over the period. An unhedged strategy would be better. Ideal strategy is currency options:
  Call options: the right to buy. Exercise when S > K
  Put options: the right to sell. Exercise when S < K
- Money market hedge:
  Receivables: borrow present value in dollars, covert dollars to home, repay in dollars
  Payables: convert present value of payable to dollars, invest, make payment with dollar investment.

Review of Techniques

	To Hedge Payables	To Hedge Receivables
Futures hedge contract(s)	Purchase currency futures contract(s)	Sell currency futures
Forward hedge	Negotiate forward contract to buy foreign currency	Negotiate forward contract to sell foreign currency
Money market hedge currency.	Borrow local currency. Convert to foreign currency. Invest till needed.	Borrow foreign currency. Convert to local Invest till needed.
Currency option hedge	Purchase currency call option(s)	Purchase currency put option(s)

Chapter 12. Managing economic exposure and translation exposure

The home currency is the functional currency.

Economic exposure includes transaction exposure, but also any impact of exchange rate fluctuations on a firm's future cash flows. The income statement is used to derive estimates. MNCs may restructure their operations to reduce their economic exposure. Restructuring involves shifting the sources of costs or revenues to other locations. Recommended actions:

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Goal: Reduce differences between foreign currency inflows and outflows	Recommended action when foreign currency has greater impact on	
Type of operations	Cash Inflows	Cash Outflows
Sales in foreign currency units	Reduce foreign sales	Increase foreign sales
Reliance on foreign supplies	Increase foreign supply orders	Reduce foreign supply orders
Proportion of debt structure representing foreign debt	Restructure debt by increasing debt payment in foreign currency	Restructure debt by reducing debt payment in foreign currency

Appreciation has unfavourable effect on revenues, favourable effect on costs.

Depreciation has unfavourable effect on costs, favourable effect on revenues.

Chapter 15. Long-term financing

Cost of debt financing:

- Based on different interest rates among currency
- Based on the exchange rate where the borrowed money is covered into another currency
- Goal: reduce financing costs

The cost of financing in a foreign currency is influenced by the value of that currency when the MNC makes coupon payments to its bondholders and when it pays off the principal at the time the bond reaches maturity. If the borrowed currency appreciates, a MNC needs more funds to pay back the coupon or principal payments. A depreciating currency will reduce its financing costs.

The international fisher effect states that home interest rate should be the same as foreign interest rate when changes in the exchange rate are taken into account. If foreign interest is higher, then the foreign currency should fall to offset the higher interest rate.

MNCs may be able to offset their exposure to exchange rate risk by issuing bonds denominated in the local currency. Issuing debt in that currency may be used to offset the exposure: use cash inflows to repay the debt.
An alternative is issuing debt denominated in home currency at a lower interest rate but with exposure to exchange rate risk.

Diversifying among currencies: a UK MNC may denominate bonds in several foreign currencies to prevent that appreciation of any one currency will not drastically increase the number of pounds needed to cover the financing payments.

A firm can finance in several currencies without issuing various types of bonds, and thus avoiding high transaction costs, by developing a currency cocktail bond, denominated in a mixture of currencies.

The debt maturity decision should include:

- The expected life of the investment
- The cost and risk of refinancing
- The exposure to exchange rate movements
- Regulatory and legal constraints
- The yield curve of the currency: difference in annual rate for bonds of differing maturities.
  The slope is referred to as the term structure of interest rates.
  Upward slope: investors expect economic growth or rising inflation, known as expectations

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theory.
Liquidity hypothesis: longer-term commitment to hold bond to maturity. Compensation for the greater inconvenience.
Market segmentation hypothesis: rates are determined by a different set of users. Long term required higher return.

Managing exchange rate risks through swaps:

Alternative to forward contracts and futures. Swap earnings of 1 currency in return for the other currency earnings. Reduce exposure to exchange rate movements. Swaps are especially useful with periodic cash flows.
Currency swap: different interest rates on currencies

Long-term financing

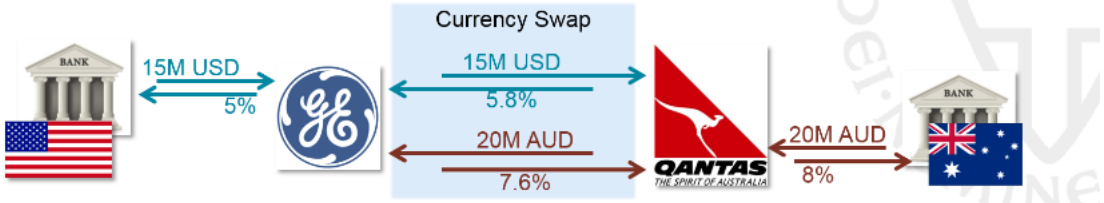
Managing exchange rate risk

Suppose GE (US) *wants to borrow* 20M *AUD* and Qantas (Australia) *wants to borrow* 15M *USD*. Assume the exchange rate for the AUD 0.75 USD. Can they enter a *swap* that benefits both firms?

	USD	AUD
GE	5.0%	7.6%
Qantas	7.0%	8.0%
Difference	2%	0.4%

Quoted interest rates

What would happen if GE borrows in US and Qantas in Australia?



Plain vanilla swap/interest rate swap: floating versus fixed interest rate players.

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Suppose Quality plc wants to borrow with a floating rate and Risk plc wants to borrow with a fixed rate.
Can they enter a *swap* that benefits both firms?

	Fixed rate bond	Floating rate bond
Quality plc (prefers floating rate)	9%	LIBOR + 0.5%
Risk plc (prefers fixed rate)	10.5%	LIBOR + 1%
Difference	1.5%	0.5%

What if Quality plc issues a fixed rate bond and Risk plc issues a floating rate bond?

Chapter 18. Short-term financing

Sources of short-term financing:

- Euronotes: unsecured debt securities. Interest rate is based on the LIBOR (eurobanks charge this on interbank loans)
- Euro-commercial paper: a promissory note (IOU) issued by MNC to borrow for max. 1 year. Minimum of 500,000 dollar.
- Eurobank loans: direct loans from Eurobanks.

MNCs consider foreign financing to offset net receivables in that foreign currency, or because the interest rates are low, or the currency is stable.

The effective financing rate may differ from the quoted interest rate. It accounts for the changes in exchange rate value and the interest rate. When the foreign currency appreciates, the effective financing rate turns out to be higher. The expected rate of depreciation or appreciation should be taken into account.
Effective financing rate: $r_{eff} = (1 + i_f) * (1 + e_f) – 1$

Appreciation → r_{eff} increases
Depreciation → r_{eff} decreases

Econometrics part

Multiple regression analysis

Conditional mean: average value of Y for a fixed value of X.

A regression creates a linear relationship between explanatory variable (X) and the dependent variable (Y). The regression lines goes through the conditional means.

A typical linear (regression) equation: yi=a+b1x1+b2x2+ei

Re-arranging terms: ei=yi(a+b1x1+b2x2)

$$Q(\beta) = \sum_{i=1}^{N} [y_i - \hat{y}_i]^2$$

$$= \sum_{i=1}^{N} [y_i - (\hat{\beta}_1 x_{i,1} + \hat{\beta}_2 x_{i,2} + \ldots + \hat{\beta}_n x_{i,n})]^2$$

Ordinary least squares (OLS): collection of beta coefficient such ≠that the error term is minimized. The sum of squared errors as small as possible. Actual y – estimated in model

Classic Linear Regression Model Assumptions:

1. Regression model is linear in parameters, but may not be linear in the variables Y and X.
2. Regressors are assumed to be fixed or non-stochastic in the sense that their values are fixed in repeated sampling. Results should be consistent.
3. Zero mean value of disturbance. Computing conditional values that are in the middle, above and below cancel each other out.
4. Homoscedasticity: variance of error is constant.
   var(ei | xi) = E(ei - E(ei)| xi)^2= σ^2
   For every value of X, distribution errors should be the same, regardless of the value of X.
5. No autocorrelation: errors between themselves should not be correlated. Observation should be independent.
   Covar(ei , e, | xi) = 0 , i ≠ j
6. No multicollinearity: error correlated with independent variable, should not be the case.
7. The number of observations must be greater than the number of parameters to be estimated. This is called overfitting.
8. On the basis of 1 until 7, it can be shown that the method of OLS provides linear estimators, unbiased, and efficient. BLUE estimators: best linear unbiased estimators.

Gauss-Markov theorem:
Want to estimate with the smallest estimate possible. Wider distribution → more variance.
Prefer coefficient from normal distribution → probability that coefficient is equal to what it should be is high.

Functional forms

Why use log?

- Allows us to improve the fitting of our model
- Interested in explaining average values. Highly skewed messes the data up → use log.

Log-log models:

- Log in the independent variable, and log in the dependent variable.
- Elasticities: coefficient tells us how much Y increases in % for a % increase in X.
- 1% increase in ln(x) → beta % increase in ln(y)
- ln(y)i= a+ b1Ln(x)+ e

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Log-lin models:

- Dependent = log, independent = linear
- ln(y)i= a+ b1(x)+ e
- Constant proportional change in X , % change in Y
- Percentage change in Y = $(e^b - 1) * 100\%$
- 1 unit increase in X → Y increases with %

Lin-log model

- Dependent = linear, independent = log
- (y)i= a+ b1Ln(x)+ e
- % change in X, absolute change in Y
- If X increases with 1% → beta/100 increase in Y

Polynomial model:

- y=a+b1x+b2x^2+b3x+ e
- Squared effects: earn more money the older you get. It is not a linear relationship. It increases to a certain point, then expect to decrease.
- $\frac{\partial y}{\partial x} = b1 + 2 * b2$ This is the change.
- If X increases with 1, Y increases by the above. B1 is the level effect, and b2 the higher order term.

Qualitative explanatory variables

With qualitative/categorical variables, use dummy variables:

- 2 categories: binary variables
- With more than two categories: value of dummy variables has to add up to 1. You can only belong to 1 category.
- Dummies = indicators = categorical = qualitative variables
- You can answer a dummy as 1 or 0, yes or no
- Dummy trap: belonging to categories is exclusive, you cannot pick 2 categories, otherwise dummy trap and multicollinearity problem. You add 1 variable in the regression: men OR woman, not both.
- Using dummy variables results in a regression equation having different intercepts for the different qualitative conditions specified by the dummy variables.
- Y = a + bDummy1 + b2x2
- Dummy1 = 0 → y = a + b2x2 → a is intercept
- Dummy1 = 1 → y = a + b1 + b2x2 → (a + b1) intercept

Interaction effect:

- An interaction is the multiplication of two or more independent variables in a regression equation.
- Variable is contingent on another variable
- Change in dependent variable with respect to an independent variable depends on the level of another independent variable.
- Calculate partial derivatives:
- Y = a + b1w + b2m + b3wm

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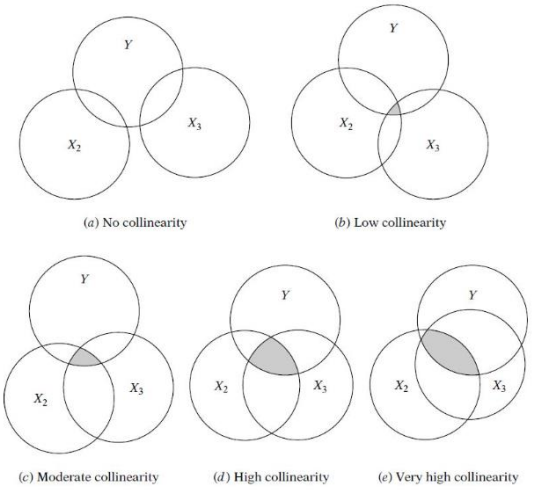
- $\frac{\partial w}{\partial m} = b2 + b3w$
- If dummy = 1, effect is b2 + b3
- If dummy = 0, effect is b2
- The coefficient of the interaction effect is the difference between dummy variables (e.g. difference in salary of women and men)

Multicollinearity

1. One of the assumptions of the CLRM is that there is no linear relationship among the regressors.
   - Perfect collinearity: you can define one of the independent variables as a function of another independent variable. F
   y = a + b1x1 + b2x2 + b3x3 + e
   x2 = 1 - 3x3
   - Imperfect collinearity: you can define one of the independent variable as function of another one + error
   - y = a + b1x1 + b2x2 + b3x3 + e
   - X2 = 1 – 3x3 – η (elasticity)
   - Collinearity is a matter of degree, not a yes or no thing.
   - Interaction effect with continuous variables (x1 * x2) is not perfect collinearity. But, avoid creating a new variable (x3 = x1 * x2) which shows the interaction effect, because then you create collinearity.



If multicollinearity is less than perfect, the regression coefficients, although determinate, possess large standard errors(in relation to the coefficients themselves), which means the coefficients cannot be estimated with great precision or accuracy. Consequences of having a degree of multicollinearity:

- large variances and covariances imply lower
- wide confidence intervals
- coefficient values of other variables in the regression altered
  →
  Economic conclusions due to statistical inferences become shaky

T statistic = estimated coefficient / standard error
If t is low, you have lower significance.
→ You conclude more often that an effect is insignificant.

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How to detect multicollinearity?

- High R-squared but few significant t-ratios
- Large standard errors in relation to the coefficients themselves
- High pair-wise correlations among regressors (> 0.4)
- Auxiliary regressions

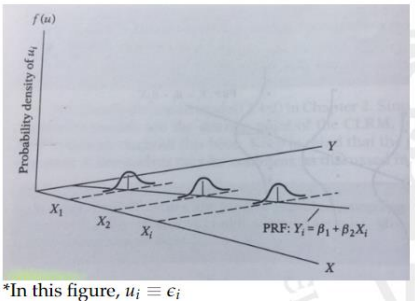
There is not test for multicollinearity, it is just observing. Run it with independent variables.
With the VIF command in Stata, (variance inflation factor), you can detect how bad the problem is.
> 3 is high collinearity. 5 is worrying.

How can we fix multicollinearity?

- Do nothing, but only if the damage is not consequential. If it's a control variable with high multicollinearity, if independent variable is not affect by multicollinearity among control variables, then it is not worrying.
- Follow some rules of thumb:
  - Drop variables with high collinearity → but omitted variable bias.
  - Transform variables into log
  - Get more data, but only if it is related to your sample. Not irrelevant data.
  - Factor and principal component analysis. Extract variation.

If we drop variables →
Standard errors of other variables may decrease →
Effects may become significant →
Calculate correlation again →
Still highly correlated? Go through whole process again.

Under the Gauss-Markov Theorem, we assume that the errors have a zero mean, constant variance, and they are uncorrelated, i.e. we assume homoscedasticity. The distribution of the errors is constant.



*In this figure, $u_i \equiv \epsilon_i$

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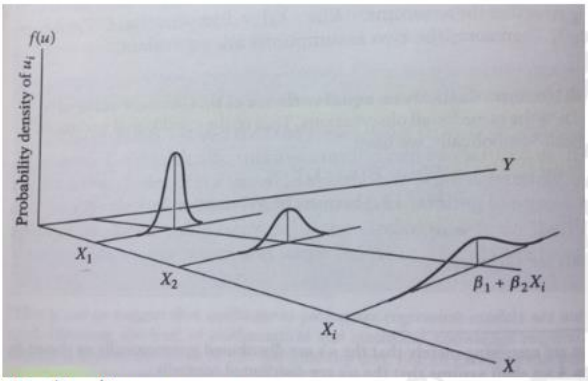
2. Heteroskedasticity



*In this figure, $u_i \equiv \epsilon_i$

- No constant variance
- This is a problem, because variance that you need for coefficients are not valid.
- T-Test and F-test is not valid.
- OLS estimators are not valid and not efficient.
- Which can lead to drawing wrong conclusions.

How can we detect Heteroskedasticity?

- summary statistics: is the dependent variable's max>>min?
- plotting residuals
- Breusch-Pagan (BP) test: tests the null hypothesis that the error variances are all equal versus the alternative that the error variances are a multiplicative function of one or more variables
- White's test
- There are no hard-and-fast rules for detecting heteroskedasticity, only a few rules of thumb
- If you find a pattern/relationship, there is heteroskedasticity.
- In the presence of heteroskedasticity, regressors are statistically different from zero

How to fix?

1. Transform regression: take ln of dependent variable to correct skewness.
2. Use robust standard errors. Reg, r

Another assumption of CLRM is that the model is correctly specified:

3. Correctly specified:
   - The model does not exclude any core variables: include the important ones.
   - The model does not include superfluous (irrelevant) variables.
   - The functional form of the model is suitable chosen (log if skewed)
   - There are no measurement errors in the dep/ind/control variables.
   - Outliers have been corrected, because they may heavily influence
   - P distribution of error is correctly specified
   - The model includes stochastic regressors (no deterministic independent variables)
   - There is no simultaneity bias: dep can explain ind, but ind can also explain dep

Check for multicollinearity, heteroskedasticity and misspecification.

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The guide for the awesome analyst:

- Use common sense and economic theory
- Know the context
- Inspect the data: know it and understand it like the palm of your hand
- Look long and in-depth at your results
- Understand the costs and benefits of data mining
- Be prepared to compromise
- Do not confuse statistical significance with meaningful magnitude: small coefficient, but very significant → not meaningful.
- Report a robustness test
- Do you get the "wrong" sign? Check again.
- Don't automatically discard a variable that is insignificant

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