International Finance Lectures

Biwei Chen

International Macroeconomics and Finance – Anatomy and Synthesis
- International: Open in theory, global in practice, plus historical perspective
- Micro: Individual and Social Choices. Price & Quantity. $Q_D(P)=Q_S(P)=Q(P^*)$
- Macro: Aggregate Economy. Income & Money. Quantity Equation: $PY=MV$
- Finance: Asset Allocation and Valuation. Return & Risk. $PV=FV/(1+i)^T$

Lecture 1 Global Economy and Monetary System

I. Global Economy: Data and Measurement
1. National incomes: GNI, GDP, RGDP, GDP per capita, GNP
2. Economic growth: percentage change in real output/income
3. Labor market conditions: UR, LFPR, EPR, unemployment claims
4. Inflation rate: annual percentage change in price level. CPI, PPI, PCE
5. Money and currency: US dollar, euro, gold, repo, cryptocurrency, MMMFs
6. Financial markets: bond/stock/credit/commodity/derivative/forex/real estate
7. Monetary policy: money and credit supply, interest rates, forward guidance
8. Fiscal policy: government deficit & debt; taxation; social insurance & welfare

II: Financial Markets: Return and Risk (R&R)
1. Risk-free rate R_f : T-bill, EFFR, Repos (collateralized), LIBOR (unsecured)
2. Yield to maturity YTM: RoR holding the asset to the end (annualized)
3. Absolute return $P_t - P_{t-1}$ and rate of return (RoR) $R_t=(P_t - P_{t-1})/P_{t-1}$
4. Historical expected return: $E(R)$, which is unconditional RoR
5. Excess return: $R-R_f$ or $R-E(R)$, which is also unconditional
6. Abnormal return: $R-E(R|X)$, which is conditional on X
7. Risk premium: $E(R)-R_f$ or $E(R|X)-R_f$ (bond/equity/forex)
8. Volatility risk: 1) $V(R)$, SD, MAD; 2) VIX; 3) GARCH
9. Liquidity risk: Credit spread $R-R_f$ (TED: LIBOR–T-bill)
10. Inflation & recession risk: Yield curve spread $(Y_1 - Y_s)$

III. Global Interconnectedness
1. International trade: cross-border goods and services; migration; institutions; policies
2. International capital flows: FDI, financial investments, primary & secondary incomes
3. Global balance: international trade and money balances; foreign credit and debt balances

IV. Foreign Exchange Markets
1. Exchange rate data and measurements
2. Exchange rate determination models
3. Exchange rate and economic adjustment
4. Exchange rate policy, regimes, and crisis

Lecture 2 Foundations of Economics and Finance

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I. Price Theory (Classical and Neo-classical)
1. The law of demand as derived from the law of diminishing marginal utility
2. The law of supply as derived from the law of diminishing marginal product
    1) $Q_D(P)=Q_S(P)$: 1) D+ → Q & P ↑; 2) S+ → Q↑ & P↓; 3) undetermined cases
3. Market efficiency: 1) MB=MC & 2) Max(TB-TC); 3) partial and general equilibrium
4. Market failures: 1) market power; 2) public goods; 3) externalities; 4) asymmetric information
5. Coase theorem (invariance theorem)
    1) the delineation of rights is the prelude to market transactions
    2) market is efficient when transaction cost is sufficiently low
    3) efficiency independent of initial wealth distribution

II. Money Theory (Monetarism and Keynesianism)
1. Flow vs Stock: value in a given period vs value at an instant of time
2. Nominal vs Real: monetary value vs quantity measures
3. Money definition: money is a standardized medium of exchange
4. Money functions: 1) medium of exchange; 2) store of value; 3) unit of account
5. Money evolution: driven by financial innovations to reduce transaction costs
6. Money stock measures: M0, M1, M2 in terms of liquidity
7. Quantity equation of money: $MV=PY$
    1) M – money in circulation
    2) V – transaction velocity
    3) P – aggregate price level
    4) Y – real output or income
    5) Transaction equation is derived from the role of money as a medium of exchange
    6) Which variable is the most vital in economic life? Y → MVP
    7) "Inflation is always and everywhere a monetary phenomenon." (Derivation)
    8) Price is sticky and money is not neutral because it affects output.
8. Money demand $M_D = L(Y, P, i)$
    1) Liquidity preference: individuals hold money (cash) because it is the most liquid medium of exchange whereas the opportunity cost of holding cash is the interest forgone
    2) Transaction demand: $M_D = kPY$, positively determined by the income and price level
    3) Investment demand: $M_D = i/h$, negatively determined by the market interest rate
9. Money supply M_S (assume exogenous as set by policy)
    1) Monetary (directly) and fiscal (indirectly) authorities; financial and business institutions
    2) What would happen to money market interest rate if the Fed purchases Treasury bonds?
    3) What would happen to market interest rate if global investors start to dump Treasury bonds?
10. Money market equilibrium: $M_d/P=L(Y, i)=M_s/P=Y/V$ → $i=i^*$ (M/P is called real money balance)
11. IS-LM model: output-money market simultaneous equilibrium (special case of liquidity trap)
12. AD-AS model: Aggregate output and price determination (SRAS vs LRAS)
13. IS-LM liquidity trap corresponds to horizontal aggregate supply curve
14. DSGE model: dynamic stochastic general equilibrium

III. Interest Theory (Irving Fisher, 1930)
1. Income = Consumption + Investment
   1) Income is the alpha and omega of economic life.
   2) Consumption: goods and services in output markets
   3) Real investment: assets and capitals in output and labor markets
   4) Financial investment: assets and capitals in financial markets
   5) Investment is the balancing of consumption over time.
   6) Saving is a form of investment, so is durable consumption.
   7) The purpose of investment is for higher future consumption.
2. Capital (asset) generates income.
   1) Income is derived from the capital. No capital, no income.
   2) The value of capital is derived from the value of income.
3. Interest is the cost of borrowing and return to lending.
   1) Determinants: consumption impatience and investment opportunities
   2) Interest rates: percentage return from initial investment
   3) Interest rate is determined in the income market equilibrium.
   4) Interest rate US data H.15 statistics: risk structure and term structure
4. Individual financial decision model
   1) Income budget constraint (opportunity set in income market): initial endowment of income now and later; a fixed market interest rate $R=1+r$ at which individuals are free to exchange their incomes by lending or borrowing
   2) Consumption time preference: indifference curve between current and future consumption
   3) Assumption: diminishing marginal rate of substitution between current and future consumption
   4) Optimal decision: tangency between the budget constraint and the indifference curve
5. Income market equilibrium model
   1) Demand: impatience to consume → immediate income $Qd=Q(i)$
   2) Supply: opportunity to invest → savings and loans $Qs=Q(i)$
   3) Equilibrium: market interest rate balances demand for and supply of income
6. The Fisher equation: nominal interest rate equals real interest rate plus expected inflation rate
   1) In a moneyless world, $i=r$ always holds; in a world with money inflation kicks in
   2) Forward-looking interest rates: Ex ante vs ex post variables
   3) Real interest rate and expected inflation rate not observable
   4) Why approximately equal? Derivation: $(1+r)(1+pi) = 1+i$
7. Fundamental equation of asset pricing
   1) $P=PV=FV/(1+i)^T$ the value of capital is derived from the value of income
   2) FV is the projected future cash flows, T is the arrival time of the FV
   3) Discount rate i is the cost of capital and the discount factor is $1/(1+i)^T$
   4) Risk premia drive i: inflation, term, credit/default/counterparty, liquidity, foreign exchange, geopolitical, public policy, environmental, ecological, terrorism
   5) Long-term asset performance of various asset classes: R(Small-cap>large-cap>corporate debt>government debt); V(Small-cap>large-cap>corporate debt>government debt).
8. Interest rate structures
   1) Credit risk structure: relations between interest rates of different credit-ratings
   2) Term structure: relations between short-term and long-term interest rates (yield curve)

Lecture 3 National and International Accounts

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I. Open-Economy Macroeconomic Policy
1. Goal for the policy makers: maintain economic balance
2. Internal balance: full employment and price stability
3. External balance: optimal current account and external wealth
4. What are the optimal levels? Theory? Evidence?
5. How to measure balance in practice? BOP & NIIP.

II. Financial Statements
1. Balance sheet: A=L+E
2. Income statement: income flows
3. Cash flow statement: money flows
4. Owners' equity statement: shareholder equity

III. International Accounts
1. Measure international transactions with the rest of the world: BOP and NIIP (EW)
2. Data: US Bureau of Economic Analysis - International Economic Accounts (w)
3. Balance of Payments (income statement)
    1) CA= TB (EX-IM) +NFP (primary) +NUT (secondary)
    2) FA= Net financial assets trade (FDI + portfolio investment + others)
    3) KA= Net trade in non-financial and non-produced assets plus capital windfalls
4. Recording BOP accounts
    1) BOP=CA+FA+KA=0
    2) Credit: CA+, FA+, KA+
    3) Debit: CA-, FA-, KA-
    4) Rule: Money in + out –
    5) Balance: CA=-FA-KA
    6) SD=-(CA+FA+KA)
5. From national to international accounts
    1) GNE=C+I+G
    2) GDP=GNE+TB
    3) GNI=GDP+NFP
    4) GNDI=GNI+NUT=GNE+CA
    5) Recall that CA=TB+NFP+NUT
6. Net International Investment Position (balance sheet)
    1) Data and historical patterns of U.S. external position: The international investment position (IIP or NIIP) is a statistical balance sheet that presents the dollar value of U.S. financial assets and liabilities with respect to foreign residents at a specific point in time. (w)
    2) NIIP=External Wealth=Net Worth=External Assets- External Liabilities
    3) From BOP to NIIP: $W_1 - W_0 = I_1$ (from income to wealth)
    4) Change in external wealth = CA+KA+VE = -FA+VE (how to increase EW?)

5) Recall CA+KA=-FA, BOP is always balanced.
6) Valuation effect (VE)= price effect + exchange rate effect + changes in volume and valuation
   a. Price changes are changes in the value of an asset or liability due to changes in the market price of a financial instrument.
   b. Exchange rate changes are changes in the value of foreign-currency denominated assets and liabilities due to changes in the values of foreign currencies relative to U.S. dollar.
7) Balance sheet composition and valuation effect:
   a. For US, dollar depreciation will increase its external wealth (exorbitant privilege). Why?
   b. For US, what would happen to its external wealth position if USD appreciates?
   c. For most developing countries with foreign debts (liabilities), home currency depreciation will decrease their external wealth position (original sin). Why?
   d. For some countries holding huge amounts of foreign assets, what would happen to their external wealth positions if their home currencies depreciate against the foreign currency?

IV. Global Imbalances
   1. BOP is always balanced.
   2. Global BOP is always balanced.
   3. Surplus countries must finance deficit countries.
   4. IMF Video (202007): Debt Sustainability 3:24 (w)
   5. Global imbalances refer to large persistent either deficits or surpluses.
   6. Why are some countries in deficit and others in surplus?
      1) Closed economy GNE=C+I+G and I=(Y-C-T)+(T-G)=S
      2) Open economy GNDI=C+I+G+CA and I=(Y-C-T)+(T-G)-CA=S-CA or S=I+CA
   7. Debt sustainability model
      1) Inter-temporal budget constraint: wealth, income, and real interest rate
      2) Two-period budget: W0, W1, W2; initial debt must be financed by future trade surplus
      3) Infinite-horizon budget (LRBC): W0, …, W~; initial wealth permits future trade deficits

$$\underbrace{-(1+r^*)\,W_{-1}}_{\substack{\text{Minus the present value of}\\\text{wealth from last period}}} = \underbrace{TB_0 + \frac{TB_1}{(1+r^*)} + \frac{TB_2}{(1+r^*)^2} + \frac{TB_3}{(1+r^*)^3} + \frac{TB_4}{(1+r^*)^4} + \cdots}_{\text{Present value of all present and future trade balances}}$$

$$\Delta W_N = \underbrace{W_N - W_{N-1}}_{\substack{\text{Change in}\\\text{external wealth}\\\text{this period}}} = \underbrace{\underbrace{TB_N}_{\substack{\text{Trade balance}\\\text{this period}}} + \underbrace{r^*\,W_{N-1}}_{\substack{\text{Interest}\\\text{paid/received}\\\text{on last period's}\\\text{external wealth}}}}_{\text{Conventional effects}} + \underbrace{\underbrace{(r^*-r^0)\,L}_{\substack{\text{Income due to}\\\text{interest rate}\\\text{differential}}} + \underbrace{KG}_{\substack{\text{Capital gains}\\\text{on external}\\\text{wealth}}}}_{\text{Additional effects}}$$

V. International Imbalances and Economic Conflicts
   1. Recent experience (global financial crisis and sovereign debt crisis) and historical evidence
   2. UK and CH Opium war: persistent trade deficit in UK → opium trade → opium war
   3. WWII and Bretton woods: trade surplus in US during the WWII → rising economic power → establishing the dollar-gold standard post WWII international monetary system
   4. Latin American crisis in the 1980s (external debt default)
   5. Asian financial crisis in the 1997 (BOP and exchange rate crisis)

Lecture 4 Introduction to Foreign Exchange Market

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I. Overview
1. Market size and turnover
2. Institution and technology
3. Market microstructure

II. Measurements
1. Bilateral rate (B.R.): the exchange rate between a pair of two currencies
2. Cross rate (C.R.): compute indirectly from two pairs of three currencies
3. Effective rate: a currency index weighted by trade volume among a basket of currencies
   1) Formula: $EER = sum(w_i * ER_i)$ where w is the trade weight for the currency pair
   2) Information: overall strength of a currency against its counterparties
4. Real exchange rate: the "price" of a foreign F basket in term of home H baskets
   1) $\mathbf{RE_{H/F} = NE_{H/F} (P_F / P_H)}$, where NE is the nominal bilateral rate.
   2) Example: $E = 100Y/S$, the price of apply in JP is $P_{JP} = Y120$ and in US $P_{US} = \$1$, what is the RE? 0.83 JP basket/US basket. Where is USD more valuable? Where is the cost of living lower?
   3) Intuition: The idea is to compare the **purchasing power of two currencies**
      a. Choose a standard basket of goods and services and measure its prices
      b. P_F is the price of the basket in F currency and P_H is the price of the basket in H currency
      c. $NE_{H/F} * P_F$ cancels out foreign currency unit and converts the price of one foreign basket into home currency unit; $(NE_{H/F} P_F)/P_H$ is the quantity of home basket to which a foreign basket is equivalent: **How many home baskets can swap for a foreign basket**?

III. Financial Derivatives
1. What is a financial derivative?
2. Function: 1) hedging against downside risk; 2) speculation for profit.
3. Contract specifications: 1) underlying asset; 2) maturity/settlement date; 3) exercise price;
4. Forward: an OTC contact for an asset that will be delivered at a specified price on the settle date.
5. Future: a standardized forward contact settled by an exchange with margin requirement
   1) Spot rate (current market rate) vs forward rate (expected future rate)
   2) Example: Korean import companies can hedge dollar appreciation risk by buying a futures contract with a forward rate of $1\$=1000W$. Exchange rate risk in the spot market is dotted line.
   3) Payoff to the Korean import company (pay USD): ER>1000, payoff=ER-FR>0; etc.
   4) Payoff to the Korean export company (receive USD): ER>1000, payoff=FR-ER<0; etc.
   5) The payoff in the futures market offsets the payoff in spot market (imports & exports).
6. Option: right but not obligation to deliver the underlying asset at a specified price at maturity.
   1) Option provides a hedge against downside risk with a potential upside benefit.
   2) Long call payoff: ER>1000, payoff=ER-FR-OF; ER<1000, payoff=-OF. Option fee is the cost.
   3) Long put payoff: ER>1000, payoff=-OF (market price is higher, should always sell at a higher price. The contract is not exercised but the holder); ER<1000, payoff=FR-ER-OF.
7. Swap: a contact through which two parties exchange the cash flows or liabilities from two different assets. Products: inflation swap, credit default swap, interest rate swap, and commodity swap. Currency swaps provides emergent liquidity among the CBs in the global financial crisis. (w)

Lecture 5 Exchange Rate Determination Models

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I. Exchange Rate Patterns
1. Fixed exchange rate vs floating rates
2. Macroeconomic determinants, speculation, and expectation
3. Demand and supply in the FX market
    1) Demand: derived from international trade and investment
    2) Supply: managed by central bank and large financial institutions
    3) Model: P_H (price of a currency in terms of a foreign currency) and Q_H
    4) Demand for a currency must be met by supply of a counterparty currency.
    5) Asset demand is driven by asset performance (store of value): return and risk.

II. Foreign Exchange Spatial Arbitrage
1. Simple strategy: "buy low and sell high."
2. Bilateral arbitrage: involves a pair of currencies.
    1) $1000, NY ER=0.5£/$, LN ER 0.55£/$
    2) Where is Pound cheaper to buy?
    3) Pound is cheaper in LN than in NY.
    4) Buy low: $1000*0.55=550£
    5) Sell high: 550/0.5=1100$
    6) Profit=1100-1000=100$
    7) What is the profit if the investor starts with L1000?
3. Triangular arbitrage: involves two pairs of three currencies.
    1) Bilateral rates: NY ER=0.5£/$, NY ER=0.8€/$, LN ER=0.7£/€.
    2) How to profit from $1000? Design a trading strategy and calculate the RoR?
    3) Calculate the cross rate of £/$ from €/$ and £/€. Cross rate £/$=0.7*0.8=0.56L/$.
    4) Where is cheaper to buy pound in terms of USD? Answer: from the cross rate.
    5) Sell $ for € in NY→ 800€ and then sell € for £ in LN → 800*0.7=560£
    6) To realize the dollar profit, sell £ for $ in NY → 560/0.5=1120$
    7) Profit=1120-1000=120$; Rate of Return (RoR) =120/1000=12%.
    8) How to profit from 1000£? 1000€? What is the rate of return (RoR)?
    9) Why does triangular arbitrage bring about higher RoR than bilateral arbitrage?

III. No-Arbitrage Condition
1. Bilateral Equilibrium: NY £/$=LN £/$
2. Triangular Equilibrium: B.R.= £/$=(£/€)*(€/$)=C.R.
3. Arbitrage activities keep the exchange rate in line with its intrinsic value.
4. Arbitrage leads to market equilibrium. Market equilibrium implies arbitrage-free.
5. Efficient Market Hypothesis implies arbitrage-free asset prices and returns.

In studying investors' behavior, economists look for arbitrage opportunities based on the law of one price. *Financial economics amounted to checking that two quart bottles of ketchup sell for twice as much as one quart bottles of ketchup.* Summer, Lawrence H. 1985. "On Economics and Finance." Journal of Finance, 40(3), 633-635.

IV. Exchange Rate Determination: Interest Rate Parity (IRP)
1. Finance and investment is all about Return & Risk.
2. Euro deposit 4% vs USD deposit 5%, where to invest $1M?
3. Example: USD 5%, EURO 4%. E=1$/€, F=1.03$/€. $D_\$=\$1M$
   1) Calculate the annual RoR on the USD: D•(1+5%)
   2) Calculate the annual RoR on the EURO: (D/E)•(1+4%)•F
   3) Which provides a higher RoR?
4. Risky arbitrage vs riskless arbitrage
   1) Uncovered IRP: F=expected future exchange rate=E^e
   2) Covered IRP: F=forward rate hedging with a futures contract=F
5. Interest rate parity: Summary
   1) Discrete time compounding
   2) Continuous time compounding
   3) Approximation rule: $R_\$ \sim R_C+(F-E)/E$
   4) Forward premium: (F-E)/E, risk premium in F
   5) Graphical model: X-Y is $R_\$$-E coordinate system
6. Predicting exchange rates (E=$/€): $E \sim F/(R_\$-R_C+1)$
   2) Graph: Y=A/(X+C) where A=F and X=$R_\$$ and $1-R_C=C>0$
   3) $R_\$+$ →E↓ (dollar appreciation)
   4) $R_€-$ → E↑ (dollar depreciation)
   5) F+ → E↑ (dollar depreciation)
   6) Market expectations speed up the realization immediately. Changes in expected future exchange rate (F) and unexpected policy shocks ($E-E^e$) can affect demand for a currency at present, leading to self-fulfilling prophecy in the spot market.
7. *IRP is implied by the function of money as a store of value.* ***How would inflation affect E here?***

V. Purchasing Power Parity (PPP)
1. The Economist's Big Mac Index: https://www.economist.com/news/2020/01/15/the-big-mac-index
   A Big Mac costs £3.39 in Britain and $5.67 in the US. The implied exchange rate is 0.60 £/$. The difference between the implied exchange rate and the actual market exchange rate, 0.77 £/$, suggests that the British pound is 22.2% undervalued. Here is the calculation.
   1) Big Mac $P_{US}=\$5.67$ and $P_{UK}=£3.39$
   2) Market exchange rate E=0.77£/$
   3) PPP Implied E^*=3.39/5.67=0.59£/$
   4) PPP Gap = (0.59-0.77)/0.77=-0.18/0.77=-0.23
   5) GBP is undervalued (cheaper Burger than US)
   6) USD overvalued (pricy Burger relative to UK)
2. How to arbitrage Big Mac? Answer: Buy low sell high in different markets.
3. The law of one price (LOOP): one world, one good, one price. PPP says 1£ for 1$!
4. PPP Theory: 1) $E_{H/F}=P_H/P_F$ or 2) $P_H/(E_{H/F}•P_F) = 1$ assuming no transaction costs.
5. Real PPP: $RE_{H/F}=NE•P_F/P_H$. PPP implies RE=1. (P is the price level or a basket of goods)
6. PPP test: long run convergence and short run deviations. The annual speed of convergence 15%.
7. PPP forecasting: long run convergence to PPP implied value (both nominal and real E to E^*).
8. Why deviation from PPP? 1) trade barriers; 2) heterogeneity; 3) policy distortions.
9. PPP is implied by the function of money as a medium of exchange. PPP is more of a long-run benchmark of E determination because aggregate price level adjusts slowly in the short run.

VI. Relative PPP
   1. RPPP V1: $\Delta E/E = (pi_H - pi_F)$
   2. RPPP V2: $\Delta RE/RE = \Delta E/E - (pi_H - pi_F)$
   3. The relation between IRP and RPPP
       1) Fisher equation: $R_H - R_F = (r_H - r_F) + (pi_H - pi_F)$
       2) Interest rate parity: $R_H - R_F = (F-E)/E = \Delta E/E$
       3) $r_H - r_F = \Delta E/E - (pi_H - pi_F) = \Delta RE/RE$

VII. Monetary Approach to Exchange Rate Determination
   1. Money market equilibrium (MM)
       1) Money demand: $M_D = L(P, Y, i)$, liquidity preference
       2) Money supply: $M_S = M$ (exogenous policy)
       3) Money market equilibrium: $M_D = M_S$ or $M_D/P = M_S/P$
       4) Interest rate is determined in domestic money market
   2. Foreign exchange market equilibrium (FXM)
       1) $i_H = i_F + (F-E)/E$ and interest rates are determined in money markets
       2) E is determined by differential interest rates and expected future exchange rate
   3. Simultaneous equilibrium in MM and FXM
       1) $E \sim F/(i_H - i_F + 1)$, E as a function of i and F
       2) Domestic monetary policy: $(M_S/P)_{H}+ \rightarrow R\downarrow \rightarrow E\uparrow$
       3) Foreign monetary policy: $(M_S/P)_{F}+ \rightarrow R_F\downarrow \rightarrow E\downarrow$
   4. Exchange rate overshooting
       1) Observation: exchange rate tends to be more volatile than price level in the short run (exchange rate cannot be explained by price level in the short run) and hence overshooting
       2) Assumptions: a. short-run price stickiness; b. credible permanent policy has immediate effects on market expectations; c. long-run price flexibility and money neutrality
       3) Short-run overshooting mechanism
           a) Temporary policy change (E^e constant): $M_s + \rightarrow E\uparrow$
           b) Permanent policy change (E^e changes): $M_s + \,\&\, F = E^e\uparrow \rightarrow E\uparrow\uparrow$
           c) Short run exchange rate overshooting: E3>E2, measured by $E_3 - E_2$
   5. Long-run price level, output and exchange rate adjustment
       1) Short-run price stickiness: P constant $\rightarrow \Delta P = 0$ (i=r) and M affects real interest rate then real output (money is not neutral in the short run)
       2) Long-run output: $Y = F(K, L)$, independent of P and M (money neutrality)
       3) Long-run price adjustment: P rises proportionally to M+ ($\Delta P = \Delta M \rightarrow MV/P = Y_L$)
       4) Long-run exchange rate adjustment: $M/P- \rightarrow R\uparrow \rightarrow E\downarrow$ (relative to the SR overshooting E)
   6. Monetary approach to E determination
       1) $E^* = P_H/P_F = (M/LY)_H / (M/LY)_F$ where $L = 1/V$
       2) $MV = PY$ or $M = PY/V = LPY \rightarrow P = M/LY$
       3) Dynamics: Percentage change in E* equals differential money growth rates minus differential output growth rates, assuming L or V is a constant.

Note 1: In the short run, if aggregate price level is sticky, exchange rate determination is due to the asset market equilibrium. (M+ $\rightarrow$ i$\downarrow$ $\rightarrow$ E$\uparrow$)
Note 2: "M_S+" indicates the money supply curve shifts to the right. "E$\uparrow$" means equilibrium exchange rate rises. In general, "+" means exogenous shift of the curve and "$\uparrow$" endogenous rise of the variable.

Lecture 6 Exchange Rate and Open Economy

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I. Keynesian Open Economy Equilibrium (DD-AA)
1. Key assumptions: short-run price stickiness; AD
2. National income determination: AD=Y=AS
3. AD in the open economy AD(C, I, G, CA)
    1) C=C(Y-T), Y-T is disposable income
    2) Investment and Government spending
    3) NX=EX-IM~CA(Y-T, RE)=CA(Y-T, EP_F/P_H)
    4) How do Y-T and RE affect CA? (The law of D)
4. Keynesian cross AD=AS
    1) AD-AS 45-degree line equilibrium
    2) AD=C+I+G+NX
    3) What is the slope of AD?
5. Open economy output market equilibrium
    1) Derive DD: Exchange Rate-Output (E-Y) equilibrium curve (S9)
    2) How does exchange rate affect output? Answer: E↑→ CA↑ → Q_Y↑
    3) Other factors affect output in the model (E fixed): C, I, G, T, P_F/P_H → Y
6. Open economy financial market equilibrium
    1) MM-FX simultaneous equilibrium: MD=MS & IRP
    2) Derive AA: Exchange Rate-Output (E-Y) equilibrium (S13)
    3) How does output affect exchange rate? Answer: Y↑ → MD+→ R↑ → E↓
    4) Other factors affect exchange rate in the financial market (Y fixed): MS, MD, P_H, R_F, F
7. DD-AA equilibrium: 1) endogenous E-Y and exogenous others; 2) output and financial markets

II. Open Economy Public Policies
1. Domestic policy goals: price stability and full employment (dual mandate)
2. How policy change DD-AA? Fiscal → DD & Monetary → AA
3. Temporary monetary policy: MS+ → (R↓ → E↑) → AA+ → Y↑
4. Temporary fiscal policy: G↑ or T↓ → DD+ → Y↑ & E↓
5. Aggregate economic shocks and policy response under output targeting
    1) Aggregate demand shock AD– → DD– → Y– & E↑
        a. Monetary stimulus: MS+ → AA+ → Y↑ & E↑
        b. Fiscal expansion: G+ or T– → DD+ → Y↑ & E↓
    2) Money demand shock MD+ → AA– → Y↓ & E↓
        a. Monetary stimulus: MS+ → AA+ → Y↑ & E↑
        b. Fiscal expansion: G+ or T– → DD+ → Y↑ & E↓
6. Permanent monetary policy (S24)
    1) Short-run: MS+ & F+ → AA++ → E++;
    2) Long-run: P+ → M/P– & Y– → AA– & DD– → E↓
7. Permanent fiscal policy (S25, 26)
    1) Short-run: G+ or T– → DD+ → Y+ & F– → AA– → Y↓
    2) Long-run: Y_L=Y– → DD– & AA– (money quantity is constant, weird!)

8. Exchange rate policy (S27, 28)
   1) Depreciation and appreciation: market-driven change in currency valuation D & S $\rightarrow$ E
   2) Devaluation and revaluation: policy-oriented change in currency valuation (AA $\rightarrow$ E & Y)
   3) Devaluation (revaluation) reflects a deliberate government decision, while depreciation (appreciation) is an outcome of government actions and market forces acting together. Devaluation $\rightarrow$ AA+ & MS+ $\rightarrow$ E↑ (E$_0$ $\rightarrow$ E$_1$) & Y↑ & FR↑ (CB FXI)
   4) Unexpected one-time sudden devaluation can be used to draw in more foreign reserves
   5) Expected continuous devaluation will trigger balance of payment crisis (insufficient foreign assets) marked by a sharp fall in foreign reserves (capital flight) and a rise in interest rate.

III. Macro Policy, Exchange Rate, and Current Account Adjustment
   1. CA=NX+NFP+NUT ~ CA(Y-T, RE)=CA(Y-T, EP$_F$/P$_H$)
   2. RE↑ $\rightarrow$ CA↑ and RE↓ $\rightarrow$ CA↓. Prediction is consistent with data.
   3. Macroeconomic policy and current account adjustment
      1) DD-AA model: E-Y equilibrium when CA can fully adjust to E
      2) The XX curve: E-Y equilibrium when CA is held constant
      3) The slope of DD: E↑ $\rightarrow$ EX↑ & IM↓ $\rightarrow$ CA↑ = (EX–IM) $\rightarrow$ Y↑
      4) How to hold CA constant when increasing E does not affect CA in XX?
      5) The slope of XX<DD: E↑ $\rightarrow$Y↑↑(XX)>Y↑(DD). However, XX is derived by holding CA fixed. The way to offset rising CA in XX is for Y↑↑(XX) >Y↑(DD) such that IM↑↑ (XX)>IM↑(DD).
      6) The slope of XX: holding E constant, Y↑ $\rightarrow$ IM↑ $\rightarrow$ CA↓. However, XX is defined by holding CA constant, thus E must rise so that EX can rise to offset the rise in IM.
      7) Keynote: Above XX, CA improvement; Below XX, CA deterioration
      8) Expansionary monetary policy: AA+ $\rightarrow$ E↑ $\rightarrow$ CA↑
      9) Expansionary fiscal policy: DD+ $\rightarrow$ E↓ $\rightarrow$ CA↓
   4. CA adjustment and the J-curve: CA worsens initially as E depreciates (contrary to what the theory suggests, the data shows that CA does not improve when E depreciates). The CA improvement realizes only after a while of E depreciation.
      1) Pattern: RE↑ $\rightarrow$ CA↓ initially and then gradually CA↑. Why?
      2) Mechanism: assuming short-run price and quantity stickiness
      3) CA~TB=EX-IM=PQ($)-PQ(€)=PQ($)-E($/€)P(€)Q=CA($)

Notation: "MS+" indicates the money supply curve shifts to the right. "E↑" means equilibrium exchange rate rises. In general, "+" means exogenous shift of the curve and "↑" endogenous rise of the variable.

Lecture 7 Exchange Rate Regimes and Policies

Biwei Chen

I. Regime Classification
1. Fixed exchange rate vs floating exchange rate
2. Benefit-cost comparison and economic performance

II. Central Bank Foreign Exchange Intervention
1. Central bank balance sheet: A=L+K, K is bank's own capital or net worth
    1) Assets: government bonds, foreign reserves, loans, gold (domestic + foreign) M=DB+FR
    2) Liabilities: deposits, reserves, debts, currency in circulation (domestic + foreign) M=C+R
    3) Money is central bank's liability. (Monetary base = currency in circulation + bank reserve)
    4) Money supply: M0, M1, or M2. M=domestic credit (DB) + foreign reserve (FR)=C+R
2. Central bank monetary policy transactions and effects on money supply
    1) Central bank sells foreign bond to a commercial bank. The commercial bank pays in cash. What happen to CB's BS? What happen to the money supply in the economy? (MS–)
    2) Central bank buys domestic bond from a bank via a check payment. What happen to the CB's BS? What happen to the money supply in the economy? (MS+)
3. Foreign exchange intervention (buy or sell FX): CB buys or sells foreign assets
    1) Based on the D-S model, demand and supply of a foreign currency determines the ER
    2) When FX appreciates or DC depreciates (D_F+ or $S_F- \rightarrow P_F$ rises), the CB can sell FX (D_F- or S_F+) to offset its appreciation. Why? What can the CB do if its DC over-appreciates?
4. Sterilization: FXI while keeping money supply constant [$E= P_H/ P_F = (M_H V_H/Y_H)/ P_F$]

III. Fixed Exchange Rate and FXI Model
1. Fixed exchange rate system is, de facto, a form of price control implemented by the CB.
    1) Exchange rate is the price of a currency in terms of another currency, the value of which is determined by the market forces of demand and supply.
    2) To peg its currency value, CB must stand ready to intervene in the FX market, buying and selling domestic currency (selling/buying foreign currency) to influence D & S.
2. How to peg exchange rates? Central Bank Foreign Exchange Intervention (CB FXI)
3. CB FXI model (exchange rate - money supply – reserve adjustment ER-MS-RA): Assumptions
    1) Exchange rate is pegged if CB targets its money supply with sufficient reserves
    2) Exchange rate will float when CB runs out of foreign reserve: MS=DC or M=B
    3) Fixed exchange rate is backed by FR. The backing ratio=FR/MS (currency board 100%)
    4) Sterilization (ER and MS are both targeted): RA and DC swap or tradeoff.
4. Economic shocks and monetary policy under fixed exchange rate system
    1) Negative money demand shock $\rightarrow$ MD– $\rightarrow$ i↓ $\rightarrow$ E↑ (IRP depreciation)
    2) FXI (non-S) $\rightarrow$ FR– (sell foreign assets) $\rightarrow$ MS– $\rightarrow$ i↑ $\rightarrow$ P↓ (MV/Y) $\rightarrow$ E↓ (appreciate)
    3) FXI sterilization: B+ $\rightarrow$ M+ (money supply is held constant by definition, by purchasing domestic assets, CB increases M_D in the economy to offset the negative M_D shock)
    4) FXI and CB "tricks": defend weakening E $\rightarrow$ sell FR $\rightarrow$ absorb currency $\rightarrow$ drain MS
    5) FXI sterilization and CB "tricks": swap DB for FR while keeping MS constant
    6) To avoid appreciation, CB has to purchase FR and therefore increase money supply

*7) **What happen if a negative AD shock?** AD–$\rightarrow$ P$\downarrow$ &Y$\downarrow$ $\rightarrow$ E$\downarrow$ (?) v.s. DD– $\rightarrow$ Y$\downarrow$ & E$\uparrow$ (?)*

IV. Open Economy Policy Trilemma
1. Fixed exchange rate and interest rate parity: $R_H = R_F + (F-E)/E$ $\rightarrow$ $R_H = R_F$ when F=E
2. Fixed exchange rate and money market: monetary policy targets interest rate and exchange rate
3. Fixed exchange rate and monetary policy: MP pegging E cannot affect Y, implied by AA-DD
4. **The impossible trinity:** policy can only achieve two but never three of the combinations 1) fixed exchange rate; 2) monetary policy autonomy; 3) open capital account
5. USD example: 1) free capital flows; 2) independent monetary policy; 3) floating exchange rate
6. Eurozone example: 1) free capital flows; 2) one currency (fixed E); 3) surrender MP to ECB
7. Empirical evidence: the relation between the change of interest rates under fixed and float
8. Financial openness: The Chinn-Ito index (KAOPEN) is an index measuring a country's degree of capital account openness. http://web.pdx.edu/~ito/Chinn-Ito_website.htm

V. Capital Controls, FX Intervention and Accumulation (Davis et al., 2020)
1. Emerging markets and developing economies (EMDEs) maintain significant capital controls, while the advanced economies have basically eliminated capital controls.
2. Central bank foreign exchange interventions are frequently observed in emerging market economies but not in advanced economies.
3. While central bank reserve accumulation tends to be small and uncorrelated with other types of capital flows in most advanced economies, reserve accumulation is a large and volatile component of the balance of payments in most emerging markets.
4. Central bank reserve accumulation is highly correlated with capital inflows from abroad, indicating that many emerging market central banks adjust their stock of foreign exchange reserves in tandem with surges and stops in capital inflows in order to smooth fluctuations in the current account.
5. Countries that have greater capital controls tend to be more active in using foreign exchange intervention. Capital account restrictions are much lower, and close to zero in many advanced economies. Thus, sterilized foreign exchange intervention would be ineffective in these countries.

VI. Macroeconomic Policy Effectiveness
1. Monetary policy under the currency board
   1) 100% foreign reserve backing domestic money supply MS=FR or M=R
   2) The CB defends its currency value by selling foreign reserves, which reduces C and M
   3) Hong Kong Linked Exchange Rate System: 1USD=7.8HKD (resilience and tie-up to US)
   4) Lacking autonomy of monetary policy, domestic money supply automatically adjusts one-to-one to external economic shocks. Under the currency board system, its exchange rate and interest rate stability are ensured and credible but tied up to the anchored currency economy.
2. Fiscal policy under the fixed exchange rate regime
   1) Temporary fiscal policy is very effective in the short run as opposed to money policy
   2) Permanent fiscal policy is less effective in the long run, causing further appreciation and long-run output reversal.
3. Policy (in)effectiveness in response to negative AD shock under fixed and float E
   1) Fiscal policy can offset a negative AD shock under both fixed and float system
   2) Monetary policy worsens negative AD demand shock under fixed exchange rate
   3) Monetary policy is effective to offset negative AD demand shock only under float

VII. Case study: "Attacking" a strong currency - Swiss franc
1. 2007-2009 global financial crisis → flight to safety → strong demand for CHF → interest rate hike & rapid foreign reserve accumulation & sharp currency appreciation → real appreciation → discourage export and FDI & stifles domestic employment and economic growth
2. Policy response phase I: FXI → sell foreign reserves (buy Swiss franc) & try to slow down the CHF appreciation but couldn't stop the frenzy → quantitative easing & central bank swap lines
3. Policy response phase II: ever stronger demand for CHF → imposing currency price floor & ultra-loose MP → negative i → mounting pressure on demand for CHF → currency price floor removal → sharpest appreciation and pressure release → negative policy i ever since
4. Policy trilemma: open capital account + targeted exchange rate → losing monetary autonomy
5. Throughout the process, the SNB and the financial system were competing for the CHF
6. Lesson: CB fighting against appreciation pressure and expectations must provide infinite money supply and, if not enough (which is impossible), perhaps tighten capital inflows.
7. Challenging questions: what can a CB do to stop speculative attack during an exchange rate crisis (sharp currency depreciation triggered by capital outflow and sudden stop)? What if the CB ran out of the foreign reserves? In any case, will contractionary monetary policy work? Do you expect imposing capital control to be effective?

VIII. The IS-LM-FX Model
1. Model derivation: 1) IS-LM output-money Y-i equilibrium; 2) FX: IRP E-i equilibrium
2. Policy analysis under float and fixed exchange rate
   1) MP under float: M+ → LM+ & AA+ → i↓ & E↑ & Y↑
   2) MP under fixed: no effect on i and Y (monetary policy dilemma)
   3) FP under float: G+ → IS+ → i↑ & Y↑ & E↓ → IM↑ & EX↓ & TB↓
   4) FP under fixed: more effective than under float in stimulating Y (augmented with MP)
   5) Output stabilization under float:
      a. AD– → IS– → i↓ & Y↓ & E↑;
      b. LM+ (M+) → i↓ & Y↑ & E↓
   6) Austerity under fixed E
      a. AD– → IS– → i↓ & E↑ & Y↑;
      b. Austerity causes further IS–;
      c. LM– → i↑ & E↓ & Y↓

Notation: "MS+" indicates the money supply curve shifts to the right. "E↑" means equilibrium exchange rate rises. In general, "+" means exogenous shift of the curve and "↑" endogenous rise of the variable.

Reference

J. Scott Davis, Ippei Fujiwara, Kevin X.D. Huang, Jiao Wang, 2020, "Foreign exchange reserves as a tool for capital account management," Journal of Monetary Economics https://doi.org/10.1016/j.jmoneco.2020.02.006

Lecture 8 Exchange Rate Crises and Reforms

Biwei Chen

I. Exchange Rate Crises
1. Definition: a large sharp depreciation of a currency in a period of time.
2. Intertwined financial crises in various financial sectors
   1) Currency crisis; 2) BoP crisis; 3) Banking crisis; 4) Sovereign debt crisis
3. Economic costs: 1) currency and wealth depreciation; 2) output and employment loss; 3) financial system disruption; 4) lower-than-potential growth; 5) financial → economic → social crisis
4. Causes: 1) unsustainable debt (public and private); 2) unsound risk management (excessive risk-taking and nonperforming loans); 3) unregulated financial market practices (highly leveraged investments, "bad" financial engineering and innovation); 4) unbalanced external position (foreign debt and trade deficit). Some factors are **not** causes but can exacerbate the problem: monetary and fiscal policy fallacies, overheated economy, speculative attack, and corrupted government. Why?

II. Theories and Models
1. Capital flights, BOP and exchange rate crisis
   1) BoP– & FR– ←→ capital flights → F+ (self-enforcement) → E↑
   2) Under fixed E → CB pegs E → FR– & MS– (no sterilization) → i↑ & Y↓
   3) Rising i and Y contraction accompanied exchange rate crisis
   4) BoP crisis timing: speculative attack → FR– → E↑
2. Banking crisis and central bank rescues under the fixed E (M=B+R)
   1) Lender of last resort in liquidity crisis → banks MD+ → CB loans (B+) → MS+ (FR fixed)
   2) Insolvent banks bailouts → CB buys "toxic" assets → B+ → R↓ (M fixed) → E↑ (FR=0)
   3) Temporary credit expansion (B+) can break the exchange rate peg: B+ → M+ → i↓ & E↑
   4) Permanent credit expansion, when holding M constant, will decrease FR to zero and eventually expand M=B. No R, no E peg. (B+ → R– → R=0 → E↑)
3. First generation model (M=B+R)
   1) Assumptions: Y constant, P flexible; T-G=DEF=ΔB; ΔM/M=ΔB/B+ΔR/R; R=0 → E floats
   2) Fiscal dominance (myopic): B+ → R–→ R=0 → M+ & P↑ & i↑ & E↑ (float at T=4)
   3) Speculative attack: B+ & R–→ R=0 & M– → ΔP/P=ΔM/M=ΔB/B=ΔE/E↑ (jump at T=2)
4. Second generation model
   1) Assumptions: Y variable, P sticky; cost-benefit analysis; constant benefit of E peg.
   2) Cost of pegging: output loss or recession cost (deviation from potential output Y_L)
   3) Credibility of the peg: recession (small cost) vs depression (large cost)
   4) Credible peg (smaller cost) vs non-credible peg (higher cost): non-credible peg has a higher cost than credible peg. Non-credible peg can easily trigger speculative attack (F=E^e+).
   5) Multiple equilibria: a comparison between the benefit of pegging and cost of pegging
      a. Strict peg: benefit (peg) > cost (non-credible peg) > cost (credible peg)
      b. Peg or depreciation: cost (non-credible)> benefit (peg) > cost (credible peg)
      c. Depreciation: cost (non-credible) > cost (credible peg) > benefit (peg)
   6) The CB will give up the peg if its cost is too high in a deep recession, making it non-credible.
   7) The opportunity cost of non-credible peg depends on the size of output loss but which is also the benefit either from maintaining a peg or letting it depreciate, whichever is higher.

Lecture 9 Evolution of Global Monetary System

Biwei Chen

I. Historical Evolution
1. Metallic standard: 1) silver (ancient China); 2) gold (18-19th C GB); 3) bimetallic (18th C US)
2. Bretton woods 2945: 1) USD peg to gold (1ounce=35$); 2) other currencies peg to USD
3. Post-Bretton woods: 1) USD peg; 2) delink gold; 3) USD float; 4) Euro
4. Impossible trinity characterizes different choices of GMS

II. Global Gold Standards
1. Origin and myth of Gold as money
2. Establishment: 1) Isaac Newton 1717; 2) Mercantilism; 3) The GB empire
3. Gold standard is a globally fixed exchange rate system. All currencies are pegged to gold.
4. Advantage: exchange rate stability, economic stability, and first golden period of globalization
5. Disadvantage: losing monetary autonomy and facing systematic risk, e.g., the Great Depression
6. David Hume and price-specie-flow mechanism: auto-adjustment of internal and external balance
   1) Trade deficit → gold outflow → money supply decline → deflation → deficit improve
   2) Trade surplus → gold inflow → money supply increase → inflation → surplus narrow
7. Rules of the game
   1) Free convertibility of fiat money to gold
   2) CB target currency value to par gold value
   3) BoP– → gold reserve– → MS– → i↑ → P↓

III. The Rise and Fall of the U.S. Dollar
1. WWI and WWII: US accumulated over 70% of the gold after WWII
2. Dollar famine → Dollar glut → Dollar crisis → Oil dollar → Debt dollar
3. Euro challenge: 1999 birth → 2009-2012 sovereign debt crisis
4. Dollar hegemony and debt monetization

Lecture 10 Euro in Retrospect and Prospect