EC933-G-AU – Lecture 1

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Basic Notions of Open-Economy Macroeconomics

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Plan of talk

- **introduction**
1. Old and new approaches to international finance
2. The exchange rate and the forex market
3. International interest(-rate) parity conditions: CIP&UIP
4. The balance of payments and forex reserves
5. Central bank balance sheet and intervention policy
6. Real and financial flows in the open economy: an accounting matrix
- **wrap-up**

Aim and learning outcomes

- **aim:** revise the basic notions of open-economy macroeconomics
- **learning outcomes**
  - distinguish old vs. new approaches to international finance
  - recall definitions and interpretations of the most essential concepts related to
    - the exchange rate
    - the balance of payments
  - summarise the real and financial flows in the open economy by a simple but comprehensive accounting matrix

Old and new approaches to IF/OEM

- **name** of course: *nuances* in the meaning of labels but *similar* field
  - international finance
  - international monetary economics
  - open-economy macroeconomics
  - international macroeconomics
- **subject** of course
  - delineated by this *common field* where the labels overlap
  - roughly, theories and policies of *BoP* and *XR* determination and adjustment
- **approaches** to the subject/field: *SOE* (PE) vs. *two-country* (GE)
  - *old /traditional/*: considers BoP as a phenomenon to be studied as such, by exploring the specific *determinants* of trade and financial flows
  - *new /modern/*: views trade and financial flows as the *outcome* of inter-temporally optimal saving-investment decisions by forward-looking agents

Bilateral NER: depreciation/appreciation

- the **relative price** b/n two national *currencies*
- therefore, can be expressed **reciprocally**

$$\underbrace{S_t^{H/F} \equiv \frac{n \text{ units of domestic currency}}{1 \text{ unit of } \textit{foreign} \text{ currency}}}$$

price quotation system: *price of foreign currency* in terms of home currency

1.069 (USD per 1 EUR)
1.621 (USD per 1 GBP)
0.00868 (USD per 1 JPY)

or

$$\underbrace{S_t^{F/H} \equiv \frac{n \text{ units of foreign currency}}{1 \text{ unit of } \textit{domestic} \text{ currency}}}$$

volume quotation system: *price of home currency* in terms of foreign currency

$0.93545 = \frac{1}{1.069}$ (EUR per 1 USD)
$0.6169 = \frac{1}{1.621}$ (GBP per 1 USD)
$115.20737 = \frac{1}{0.00868}$ (JPY per 1 USD)

Arbitrage on (foreign) currencies

- **definition**
  - *simultaneous* buying and selling of foreign currencies (under no costs)
  - to profit from *discrepancies* b/n the exchange rate of the same currencies
  - existing at the *same* moment but in *different* financial centres
- consistency /neutrality/ condition and **two-point** arbitrage

$$S_t^{H/F} S_t^{F/H} = S_t^{F/H} S_t^{H/F} = 1$$

- direct and indirect /cross/ (exchange) rates and **triangular /three-point/** arbitrage

$$\underbrace{S_t^{i/j}}_{\text{direct rate}} = \underbrace{S_t^{i/k} S_t^{k/j}}_{\text{indirect /cross/ rate}} \qquad S_t^{i/j} S_t^{j/k} S_t^{k/i} = 1 \text{ or } S_t^{j/i} S_t^{i/k} S_t^{k/j} = 1$$

Bilateral RER: possible definitions

- PPP-related definition

$$q_t^{PPP} \equiv \frac{S_t P_t^*}{P_t} = \frac{P_t^*}{\frac{P_t}{S_t}} \text{ or, reciprocally, } \frac{1}{q_t^{PPP}} \equiv \frac{P_t}{S_t P_t^*} = \frac{\frac{P_t}{S_t}}{P_t^*}$$

- tradables-nontradables-related definition

$$q_t^{T/N} \equiv \frac{S_t P_{Tt}^*}{P_{Nt}} \text{ or, reciprocally, } q_t^{N/T} \equiv \frac{1}{q_t^{T/N}} \equiv \frac{P_{Nt}}{S_t P_{Tt}^*}$$

- ToT- (or exportables-importables)-related definition

$$q_t^{IM/EX} \equiv \frac{S_t P_{IMt}^*}{P_{EXt}} = \frac{P_{IMt}^*}{\frac{P_{EXt}}{S_t}} \text{ or, reciprocally, } q_t^{EX/IM} \equiv \frac{1}{q_t^{IM/EX}} \equiv \frac{P_{EXt}}{S_t P_{IMt}^*} = \frac{\frac{P_{EXt}}{S_t}}{P_{IMt}^*}$$

- ULC-related definition

$$q_t^{ULC} \equiv \frac{S_t W_t^*}{W_t} = \frac{W_t^*}{\frac{W_t}{S_t}} \text{ or, reciprocally, } \frac{1}{q_t^{ULC}} \equiv \frac{W_t}{S_t W_t^*} = \frac{\frac{W_t}{S_t}}{W_t^*}$$

A refinement on bilateral RER and extension to multilateral NER and RER

- a refined empirical definition of bilateral RERs

$$q_t^{Emp} \approx \frac{S_t P_t^{*PPI}}{P_t^{CPI}} = \frac{P_t^{*PPI}}{\frac{P_t^{CPI}}{S_t}} \text{ or, reciprocally, } \frac{1}{q_t^{Emp}} \approx \frac{P_t^{PPI}}{S_t P_t^{*CPI}} = \frac{\frac{P_t^{CPI}}{S_t}}{P_t^{*PPI}}$$

- MNER or NEER index (number)

$$NEER_{it} \equiv MNER_{it} \equiv \sum_{j=1, j\neq i}^{n} \omega_j S_t^{i/j}, \qquad \sum_{j=1, j\neq i}^{n} \omega_j = 1$$

- MRER or REER index (number)

$$REER_{it} \equiv MRER_{it} \equiv \sum_{j=1, j\neq i}^{n} \omega_j q_t^{i/j}, \qquad \sum_{j=1, j\neq i}^{n} \omega_j = 1$$

- NEER and REER depreciation/appreciation

The forex market(s)

- **spot** market: transactions for *immediate* (two work days) delivery
- **forward** market and hedging
  - main function: allow economic agents to cover against /hedge/ risk
  - transactions for *future* delivery (at maturity) but exchange rate *fixed* at F_t
  - **forward margin**: *premium* if negative or *discount* if positive

    $$\equiv \frac{F_t - S_t}{S_t}$$

- **swap** market: repurchase (or resale) agreements
  - i.e. first sell then repurchase (or first buy then resale) at a *future* date with the price of both current and future transaction *preset*
  - swap rate: implied by the difference in the preset prices
- **derivative** market: futures and options
- **eurocurrency** (xenocurrency) market: eurodollars, USSR, UK

Interest(-rate) parity conditions: CIP & UIP

- spot, forward and eurocurrency rates are mutually dependent through **CIP**

$$1 + \imath_t = (1 + \imath_t^*)\frac{F_t}{S_t} \qquad \imath_t \approx \imath_t^* + f_t - s_t$$

- empirical evidence *confirms* CIP: occasional violations occur after accounting for transaction costs, but they are short-lived and in periods of high market volatility
- under *risk neutrality*, agents are willing to take unboundedly large positions on bets that have a positive expected value => expected forward speculation profits are driven to zero ⇔ **UIP**

$$F_t = E_t[S_{t+1}] \qquad 1 + \imath_t = (1 + \imath_t^*)\frac{E_t[S_{t+1}]}{S_t}$$

- *violations* of UIP are common in the data

Two-period PE portfolio problem (I)

- why UIP does not hold? => risk-*averse* agents require a **risk premium** if their forex investment is *uncovered*
- interest rate and exchange rate dynamics taken as *given*
- **portfolio problem**: invest (assuming that CIP holds)
  – a fraction of wealth ω in a safe domestic bond
  – and the remaining fraction $1\text{-}\omega$ in a foreign bond, *uncovered*
  – next-period wealth is the *payoff* of the bond portfolio

$$\mathcal{W}_{t+1} = \left[\omega(1+\imath_t) + (1-\omega)(1+\imath_t^*)\frac{S_{t+1}}{S_t}\right]\mathcal{W}_t$$

Two-period PE portfolio problem (II)

- agents: **CARA utility** over wealth

$$\mathcal{U}(\mathcal{W}) \equiv -e^{-\gamma \mathcal{W}}, \gamma \geq 0$$

- **problem**: by choosing the investment share ω, to maximise *expected* utility

$$E_t[\mathcal{U}(\mathcal{W}_{t+1})] = E_t[-e^{-\gamma \mathcal{W}_{t+1}}]$$

- for a **normally distributed** random variable $Z \sim N(\mu, \sigma^2)$ the *moment generating function* (MGF) is defined by

$$\psi_Z(x) \equiv E[e^{xZ}] \equiv \exp\left(\mu x + \tfrac{1}{2}\sigma^2 x^2\right)$$

Two-period PE portfolio problem (III)

- if people believe that $\mathcal{W}_{t+1}$ is **normally** distributed *conditional* on currently available information, with

$$E_t[\mathcal{W}_{t+1}] = \left\{\omega(1+\iota_t) + (1-\omega)(1+\iota_t^*)\frac{E_t[S_{t+1}]}{S_t}\right\}\mathcal{W}_t$$

and

$$Var_t[\mathcal{W}_{t+1}] = \frac{(1-\omega)^2(1+\iota_t^*)^2 Var_t[S_{t+1}]\mathcal{W}_t^2}{S_t^2}$$

- then maximising the expected CARA utility above is *equivalent to* maximising the simpler **mean-variance function**

$$E_t[\mathcal{W}_{t+1}] - \tfrac{1}{2}\gamma Var_t[\mathcal{W}_{t+1}]$$

- to see why, substitute $\mathcal{W}$ for Z, $-\gamma$ for x, $E_t[\mathcal{W}_{t+1}]$ for μ and $Var_t[\mathcal{W}_{t+1}]$ for σ^2 in the MGF above and take logs
- traders are now **mean-variance optimisers**: they like high mean values (return) but dislike variance (risk) in wealth

Two-period PE portfolio problem (IV)

- differentiating the *mean-variance* function w.r.t. to the *choice* variable ω and setting the derivative to zero, and then rearranging the FO(N)C for *optimality* yields

$$\underbrace{(1+\imath_t) - (1+\imath_t^*)\frac{E_t[S_{t+1}]}{S_t}}_{\text{deviation from UIP}} + \underbrace{\frac{\gamma \mathcal{W}_t (1-\omega)(1+\imath^*)^2 Var_t[S_{t+1}]}{S_t^2}}_{\text{risk premium } >0} = 0$$

- which *implicitly* determines the optimal investment ω
- and *explicitly* defines (derives) a positive **risk premium** that accounts for *deviations* from UIP under risk *aversion*

BoP: some terminology

- **definition:** a summary record of all *economic transactions* between the *residents* of a country and the nonresidents for a given period of time, e.g. a year or a quarter ⇔ a *flow* concept
- **structure:** a *table* that obeys a common set of accounting rules and conventions *standardised* by the IMF in its BoP Manual (5th revision, 1993)
- **economic transaction** means the transfer of an economic value from one agent to another: two basic *types* and five *subtypes*
  - **bilateral** (two-way) transfer: **with** *quid pro quo* => *real-financial, real (barter)* or *financial*
  - **unilateral** (unrequited or one-way) transfer: **without** *quid pro quo* => *real* or *financial*
- **resident** ≠ national or citizen
  - as regards *individuals*, residents are the persons whose general centre of interest is considered to rest in a given economy; in pragmatic terms threshold of one year
  - as regards (international) *enterprises*, definition is more complicated: splitting-up

BoP: accounting principles

- **double-entry book-keeping**
  - each international transaction of residents results in **two entries** with exactly *equal values* but *opposite signs*: a credit (+) and a debit (-)
  - therefore, the total value of debit entries equals the total value of credit entries, so that the **net balance** of all entries is *necessarily zero*
  - a **debit** entry (-) arises when a particular economic transaction gives rise to a *demand* for foreign currency; or, equivalently, when a good (or a service) or an asset (financial and real) is *"imported"* (i.e. purchased from abroad)
  - conversely, all transactions that give rise to a *supply* of foreign currency result in **credit** entries (+) or, equivalently, when a good (or a service) or an asset is *"exported"* (i.e. sold abroad)
- **timing of recording:** defines when a transaction has taken place
  - *payments* basis: at the time of effecting the *payment*
  - *commitment* basis: at the time of concluding the *contract*
  - *movement* basis: when the economic value *changes ownership* ⇔ IMF rule
- **uniformity of valuation** of exports and imports: *fob* (not *cif*)

BoP: components and (dis)equilibrium

- **current account** => CA: surplus (+) or deficit (-)
  - goods ("visible" trade): exports (+) and imports (-) => TB
  - services ("invisible" trade): receipts (+) and outlays (-) => $BS + TB \equiv NX$
    - transport(ation): freight (goods), travel (passengers) and related insurance
    - tourism: expenditures made abroad (food, lodging, local transportation)
    - business and professional services: fees related to use of copyrights/patents
  - (net) factor (or investment) income: receipts (+) and outlays (-) =>$NFI + NX$
    - for use of capital (interest and dividends, yearly) services
    - for use of labour (wages) services
  - unrequited current transfers: receipts (+) and outlays (-) => balance
- **capital (and financial) account** => KA: surplus (+) or deficit (-)
  - unrequited capital transfers: government aid
  - direct investment: FDI (effective voice in management, 10% ownership)
  - portfolio investment: bonds/shares (risk diversification), banking flows
  - up to here: KA^P; and **overall balance**, $OB \equiv CA + KA^P$(or *basic* balance: LT)
  - *errors and omissions*
  - **official settlements account** => KA^G: loss (+) or gain (-) of reserves
    - monetary gold and "paper" gold (SDRs and reserve position at IMF)
    - foreign currencies and foreign treasury bills (notes, bonds)

BoP, NER regime and central bank intervention

- **BoP** accounting identity: $CA + \underbrace{KA^P + KA^G}_{\equiv KA} \equiv \underbrace{CA + KA^P}_{\equiv OB} + KA^G \equiv 0$
- under **(pure) float**
  - NER is determined by equilibrium in forex market

  => not possible for a country to have BoP problems: overall balance $KA^G=0$ so a CA deficit needs to be financed by a (private) capital account KA^P surplus, or vice versa: $CA+KA^P=0$ or, equivalently, $-CA=KA^P$
- under **(pure) peg**
  - central banks intervene in forex market: buying or selling foreign currencies, they aim to prevent exchange rate adjustment, automatic under pure float, so that $\Delta NER=0$
  - and thus allow the overall balance to be nonzero: $KA^G \neq 0$
- **central bank balance sheet** and intervention policy

$$MB_t \equiv DC_t + NFA_t^C$$

Summary of national accounting identities

- in the ***closed* economy**
  - GDP equals GNP, ignoring *capital depreciation*: $X \equiv Y$
  - summing up all final *expenditure* by sector: $A \equiv C^P + I^P + \underbrace{C^G + I^G}_{\equiv G}$
  - assuming excess supply is met by *inventory accumulation* in firms:

$$X \equiv Y \equiv A$$

- in the ***open* economy:** a few (at least two) *modifications*
  1. another sector => *net* exports: $X \equiv \underbrace{(C^P + I^P + G)}_{\equiv DA} + \underbrace{EX - IM}_{\equiv NX}$
  2. GDP equals GNP *plus NFI*: $Y \equiv X + NFI$

  substituting *1.* in *2.* yields: $Y \equiv DA + \underbrace{(EX - IM) + NFI}_{\equiv CA\text{, ignoring unrequited } transfers}$

Real and financial flows in the open economy: an accounting matrix

- a useful way to organise thinking on the role of the *external* sector (or RoW) in *domestic* **macroanalysis**

market \ sector	private	government	banking	central bank	external	ROW totals
goods and services	$I^P - S^P$	$G - T$	~	~	CA	0
domestic monetary base	ΔMB^P	~	ΔMB^B	ΔMB	~	0
domestic bank deposits	ΔBD^P	~	ΔBD	–	ΔBD^F	0
domestic securities	ΔB^P	ΔB	ΔB^B	ΔB^C	ΔB^F	0
foreign money	$S\Delta M^{*P}$	~	$S\Delta M^{*B}$	$S\Delta M^{*C}$	$S\Delta M^*$	0
foreign securities	$S\Delta B^{*P}$	~	$S\Delta B^{*B}$	$S\Delta B^{*C}$	$S\Delta B^*$	0
COLUMN totals	0	0	0	0	0	

The current account (surplus) as

- an excess of ***national*** **saving** over **investment**: from 1st row

$$CA \equiv (S^P - I^P) + \left[T - \overbrace{(C^G + I^G)}^{\equiv G} \right]$$

$$CA \equiv S^P + \underbrace{(T - C^G)}_{\equiv S^G} - \underbrace{(I^P + I^G)}_{\equiv I^N}$$

$$CA \equiv \underbrace{S^P + S^G}_{\equiv S^N} - \underbrace{(I^P + I^G)}_{\equiv I^N}$$

$CAS \equiv CA \equiv -\Delta NFA$, so that $\underbrace{CA + \underbrace{\Delta NFA}_{\equiv KA}}_{\equiv BoP} = 0$

$CAD \equiv -CA \equiv \Delta NFA$, so that $\underbrace{CA + \underbrace{\Delta NFA}_{\equiv KA}}_{\equiv BoP} = 0$

The current account (surplus) as

- an excess of **national *income*** (GNP) over ***domestic* absorption** ≡ expenditure of *domestic* sectors on *domestic* output: from 1st row

$$CA \equiv \overbrace{\left[\underbrace{(Y - T)}_{\equiv Y_d} - C^P \right]}^{\equiv S^P} - I^P + (T - G)$$

$$CA \equiv Y - \underbrace{(C^P + I^P + G)}_{\equiv DA}$$

Overall balance and international reserves

- overall balance equals change in reserves (with a *minus* in BoP)

$$\underbrace{OB \equiv CA + KA^{P} \equiv -S\Delta IR^{*C}}\ \text{so that}\ \underbrace{\underbrace{CA + KA^{P}}_{\equiv OB} + \underbrace{\overbrace{S\Delta IR^{*C}}^{\equiv \Delta NFA^{C}}}_{\equiv KA^{G}}}_{\equiv BoP} \equiv 0$$

- *economic* (vs. accounting) meaning of:
  - current account as **intERtemporal trade** (change in NFA)

$$CA \equiv \Delta NFA$$

  - overall balance as **supply/demand for reserves** (change in NFA^{C})

$$OB \equiv \Delta NFA^{C}$$

Concluding wrap-up

- **What have we learnt?**
  - how approaches to international finance have evolved
  - the basic terminology, definitions, interpretations in OEM
  - a compact way to remember and summarise key open-economy macro-relationships
- **Where do we go next?**

  to the early models of BoP adjustment, which have employed, in turn, what has become known as the *flow*, *stock* and *stock-flow* approaches to BoP