Introduction to Macroeconomics

Lecture Notes

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1 Macroeconomics

Macroeconomics (Greek *makro* = 'big') describes and explains economic processes that concern *aggregates*. An aggregate is a multitude of economic subjects that share some common features. By contrast, microeconomics treats economic processes that concern individuals.

Example: The decision of a firm to purchase a new office chair from company X is not a macroeconomic problem. The reaction of Austrian households to an increased rate of capital taxation is a macroeconomic problem.

Why macroeconomics and not only microeconomics? The whole is more complex than the sum of independent parts. It is not possible to describe an economy by forming models for all firms and persons and all their cross-effects. Macroeconomics investigates aggregate behavior by imposing simplifying assumptions ("assume there are many identical firms that produce the same good") but without abstracting from the essential features. These assumptions are used in order to build macroeconomic *models*. Typically, such models have three aspects: the 'story', the mathematical model, and a graphical representation.

Macroeconomics is 'non-experimental': like, e.g., history, macroeconomics cannot conduct controlled scientific experiments (people would complain about such experiments, and with a good reason) and focuses on pure observation. Because historical episodes allow diverse interpretations, many conclusions of macroeconomics are not coercive.

Classical motivation of macroeconomics: politicians should be advised how to control the economy, such that specified targets can be met optimally.

policy targets: traditionally, the 'magical pentagon' of good economic growth, stable prices, full employment, external equilibrium, just distribution

of income; according to the EMU criteria, focus on inflation (around 2%), public debt, and a balanced budget; according to BLANCHARD, focus on low unemployment (around 5%), good economic growth, and inflation (0–3%). In all specifications, aim is meeting several conflicting targets simultaneously.

Examples for further typical questions to macroeconomics: what causes business cycles (episodes of stronger and weaker economic growth)? can an increase in the monetary supply by the central bank cause real effects? what is responsible for long-run economic growth? should the exchange rate of a currency be kept at a fixed level? can one decrease unemployment, if one accepts an increase in inflation?

A survey of world economics: three large economic blocks (Europe, USA+Canada, Japan+Far East) with different problems, the remainder mostly developing countries.

1. **USA**: good growth, low inflation, tolerable unemployment rate, persistent external deficit, increasing income inequality.

2. **EU**: moderate growth, low inflation, in some countries high unemployment, inconspicuous external balance (total EU active, in Austria recently turned active), for some countries large public debt, currently important unification process, convergence and heterogeneity of individual countries. 'Richest' EU countries Luxembourg, Denmark, then 'mid-field' with Austria, IRL, B, NL, UK, D, F, FIN, I, S; slightly below E, GR, SLO, P. Last come most 'new' (2004 accession) countries (from Malta down to Latvia). Very 'rich' non-EU countries Norway, Iceland, and Switzerland.

3. **Japan**: recently weak growth, large external surplus, deflationary tendencies.

2 System of National Accounts

Basic idea (not the definition)**:** Summary of all economic activities within a country's territory and within a given time range (e.g., a year or quarter) yields the **gross domestic product** (GDP). The value of all goods and services is determined at market prices (final prices, *purchasers' prices*). System for compilation of data and bookkeeping of all positions is called the *System of National Accounts* (SNA). In Europe, compilation of the SNA conforms to the ESA (*European System of Accounts*) standard.

Economic activity is mainly measured by *transactions*. Phrases from text books: diversification of labor (not complete self-subsistence) causes transactions, exchange of money for goods or services, exchange of an asset or liability for a different asset or liability, etc. The transactions take place on markets. Money makes transactions easier than direct exchange of goods for goods, which may require 'double coincidence' (hungry tailor meets freezing baker).

Purpose of money: apart from payment and storage of value primarily unit of measurement (*numeraire*). In economic text books, usually dollar ($), monetary unit (MU), or euro.

gross: many activities serve to repair or replace worn or damaged machines and objects ('depreciation'), therefore it is not the total GDP that contributes to the accumulation of aggregate wealth. In the SNA, 'gross' usually means 'inclusive of depreciation', 'net' often contains taxes, though no depreciation.

Consumption of fixed capital (in economics, *depreciation*) of SNA is the estimated wear and tear of produced means of production (this 'depreciation' should not be confused with positions in tax declarations or with changes in the currency exchange rate).

Capital stock is the stock of fixed capital (machines, buildings, ...) in enterprises and in the general government sector. This must be distinguished carefully from the informal usage of the word 'capital' as 'money, liquid wealth'. By definition, capital contains all produced means of production. The separation of capital such as machinery from intermediate consumption such as raw materials can be difficult.

economic activities: only market activities can be fully accounted for. Therefore, private exchange and domestic services pass by unnoticed. By definition, however, legitimacy of a transaction should not play a role. Therefore, the shadow economy (moonlighting) and illegal drug production are part of the GDP, but such activities are difficult to measure. A consequence of this measurement problem is an exaggerated wedge between developing countries and OECD countries (with the *per capita* GDP of Angola you cannot survive in Austria). Interest focuses on transactions—bilateral (*requited*) transactions (purchase etc.) and unilateral (*unrequited*) transactions (*transfers*)—while value changes of existing objects are not accounted fully.

value added: definition of GDP as the sum of values added in the production process (ore → metal → screw → motor part → video recorder) avoids multiple counts. Problems in the valuation of public services.

market prices: in principle, all goods and services are valued at market prices, that is, inclusive of all taxes. If data is collected at the net value (without taxes), taxes must be added.

economic agents: Resident '*institutional units*' are classified with regard to their distinctive characteristics. Types of institutional units are: private households, general government, financial and non-financial corporations (comprises most so called firms or enterprises), non-profit institutions serving households. Foreign (non-resident) units are summarized as the 'rest

of the world', provided there are transactions with resident units. The same person can be part of a private household and of an enterprise (rents out an apartment, or even only uses his/her own condo but is assumed to rent it out to him/herself).

resident is an institutional unit that is situated on a country's territory. Citizenship is not the criterion for residence. However, foreign students or short-term foreign workers are not viewed as resident.

private households: produce and invest relatively little, consume, obtain wage and profit income from corporations and from the government. As self-employed persons, they obtain '*mixed income*', though the separation of households from corporations is occasionally difficult. Small (non-corporate) firms and farms are counted as private households.

general government ('public sector'): receives taxes from enterprises and from private households, provides public goods ('consumes them by itself' according to SNA), no intention of profit.

corporations: produce and invest, do not consume, intention of profit. Corporations, not the government sector, comprise also firms in public property, if they cover 50% of their costs from sales. Because depreciation is now called 'consumption of fixed capital', it represents a kind of consumption of corporations. Corporations are either *financial* (banks etc.) or *non-financial*.

non-profit institutions serving households (NPIsH): institutions (such as schools, churches) that cover less than 50% of their production costs from sales; idea: no intention of profit. A small sector, for simplification often added to households.

rest of the world: consumes goods and services produced by residents (*exports*) and produces goods and services consumed by residents (*imports*).

imports of services: includes travels abroad by residents

exports of services: includes consumption of foreign tourists on the territory of the economy (imputed based on valuta purchases etc.)

sectors: the activities of individuals of a similar kind are added up (aggregated). The aggregate of all households forms the household sector etc., whereby transactions within the sector disappear. This 'consolidation' eliminates the exchange between households, as it does not increase collective wealth. Recorded are the production of capital within the firms, the production by private households, public consumption, which by definition is produced and consumed by the general government itself.

ex post: SNA records only after the economic processes have already occurred, therefore only limited validity for the assessment of *future* reactions in the economy. *ex ante* would be a task for economic theory.

flows and *stocks*: SNA mainly records *flows* of goods and services within a time period (for example, the consumption of Austrian households in the first half-year of 1996). Sometimes, also stocks are of interest (wealth, number of unemployed persons, central bank money, capital stock on July 31, 1996) at a fixed time point. Changes of *stocks* are *flows* (bath tub: water level at time point 1 = water level at time point 0 + inflow – outflow; inflow and outflow are *flows*; water level is a *stock*)

stocks: also short for 'common stocks' (shares) and occasionally for 'inventories' (beware of the possibility of confusion)

2.1 Matrix of transactions between sectors

The new SNA convention affects this traditional presentation (following HASLINGER), though it remains instructive and valid in principle. The NPIsH sector is omitted here, an artificial sector 'value changes' completes the transaction matrix.

Diagram of monetary flows (payments) from the row sectors to the column sectors, grossly simplified, goods flows partly in the opposite direction:

→	firms	government	households	non-residents	value changes
firms		$T_{dir,F} + T_{ind}$	$W_F + \Pi_d$	Im	$\Pi_{und,net}$
government	$subv + I_P$	C_P	$W_P + tr^H$		S_P
households	C	$T_{dir,H}$			S_H
non-residents	X				$\mathrm{Im} - X$
value changes	$I_{F,net}$	$I_{P,net}$			

names (notation as used in economics, not necessarily in SNA):

C ... (private) consumption of households

C_P ... public consumption

I_F ... investment of corporations (enterprises, firms)

I_P ... investment of general government (public investment)

('investment' always concerns means of production, not purchases of assets)

I_{net} ... investment without depreciation (wear and tear of the capital stock)

W_F ... wage payments of firms to households

W_P ... wage payments in the public sector

tr^H ... transfers to households (pensions, benefits, superscript indicates direction 'to households'; 'transfers'=unilateral transactions without counterpart)

S_H, S_P ... saving (public sector often negative)

$subv$ .... subsidies to enterprises

T ... taxes etc.

T_{ind} ... indirect taxes are deductions before the calculation of income

(mainly value added tax) including customs, officially *production taxes*.

T_{dir} ... direct taxes are deductions from earned income (wage tax, income tax etc.), including contributions to social security

Π_{und} ... undistributed profits

Π_d ... distributed profits (dividends etc.)

X ... exports

Im ... imports

Economic circuit: row sums = column sums (inflow=outflow), nothing is lost, often graphical presentation with arrows. (metaphorical analogy water: sector Atmosphere with input evaporation and output rain, sector Continents with input rain and output evaporation from inland water and outflow at estuaries, sector Oceans with input at estuaries and output evaporation from seas; earth is a closed circuit, amount of water is globally preserved)

open and closed circuit: without value changes, the economic circuit is open, for example at $X >$ Im more payments would flow to Austria than from Austria to non-residents. The hypothetical value changes sector (global bank?) loses $X -$ Im and closes the circuit.

2.2 Accounts of the SNA

The new SNA consists of a sequence of several accounts, in which many single positions are recorded, while others result as balancing items (bold type in the accounts). These accounts are calculated for all sectors (financial and non-financial corporations, public households, private households and NPIsH, rest of the world) and for the total economy.

2.2.1 Sectorial accounting

The accounts that are decomposed according to sectors (financial and non-financial corporations, public households, private households and NPIsH) are primarily income accounts, which focus on the contributions of individual sectors to national income. Point of departure is the *production account*. *Gross output* (all production at *basic prices*, i.e. without value added tax and customs) is booked on the credit side of this account. To this correspond, as uses, the *intermediate consumption* and the depreciation (*consumption of fixed capital*). The balancing item is *net value added*. The columns '*resources*' and '*uses*' correspond to the bookkeeping terms 'credit' and 'debit'.

Uses	*Resources*
intermediate consumption	gross output
depreciation	
net value added	

In the *generation of income account*, the balancing item of the production account is transferred to the Resources. From the net value added, *salaries and wages* (workers' compensation) and some (so called 'other') production taxes (e.g. payroll tax) are paid. The position 'other subsidies received' represents negative taxes, only the difference is of concern. The balancing item of this account is called 'operating surplus and mixed income', where the households and NPIsH earn mixed income, while the firms and government

receive an operating surplus:

Uses	*Resources*
wages paid	net value added
other taxes on production paid	
– other subsidies received	
operating surplus, net	
mixed income, net	

In the *account of primary income allocation*, the generation of income is turned on its head. It yields, as a balancing item, the income of the sector. For the total economy, the net value is slightly modified relative to the sum of single sectors, as primary income may also cross borders and also because of the hypothetical position 'financial services indirectly measured' (FISIM). The relative contributions by the positions differ widely across sectors. Thus, only the general government receives production taxes, while only households receive wages. The meaning of a *primary income* is that it is generated completely in the production process. By contrast, the *secondary income* is income after its redistribution through unilateral transfers. Correspondingly, production taxes (indirect taxes) show up in the primary account, but not the 'direct' taxes.

Uses	*Resources*
property income paid	**operating surplus, net**
	mixed income, net
	wages received
	production taxes received
	– subsidies paid
	property income received
primary income, net	FISIM

In the *account of secondary income distribution*, fiscal authorities show their power. Neither corporations nor private households receive direct taxes, while other transfers re-distribute income flows among all sectors. As a balancing item, this account yields the so called *disposable income*, i.e. the amount of income that is actually disposable for the sector's expenditures (or to the economy's expenditures for the aggregate account)

Uses	*Resources*
current taxes on income and wealth paid	**primary income, net**
social contributions paid	current taxes on income and wealth received
monetary social benefits paid	social contributions received
other current transfers paid	monetary social benefits received
disposable income, net	other current transfers received

In the *use of income account*, all sectors except the corporations consume out of their disposable income. The balancing item is the **saving** of the sector, with a small correction because of contributions to pension funds, which we would like to ignore. The quotient of saving and disposable income in the household sector is called the *household saving rate* and represents an important economic quantity. In Austria, this saving rate has dropped in recent years from double-digit percentages to around 8%. Occasionally, also the total saving rate is reported, which rather is a balancing item against the non-resident sector.

Uses	*Resources*
consumer expenditures	**disposable income, net**
saving, net	

In the *capital account*, saving serves as a resource for investment. After deduction of a few lesser items, the *net position of lending and borrowing* evolves as a balancing item. *Gross fixed investment* is called 'gross', as it comprises depreciation. It is called fixed investment to distinguish it from inventory investment, which is also seen as an investment. Fixed investment can be broken up into residential construction, other *construction investment* (buildings and structures, i.e. factories, streets, tunnels, ...), and *equipment investment* (machines, vehicles, ...). Gross fixed investment minus depreciation is called net fixed investment.

Uses	*Resources*
gross fixed investment	**net saving**
– depreciation	capital transfers received, net
changes in inventories	
net acquisition of valuables	
net acquisition of non-produced assets	
net position of lending and borrowing	

2.2.2 SNA for the total economy

Parallel to sectorial SNA, there is an accounting for the total economy, in which the main emphasis is on production accounts rather than on income. In these total accounts, we find the primary target variable of SNA, the *gross domestic product* (GDP). The GDP is distinct from the income items, as it relates to the production by resident units rather than to the income of residents. For production, all activities count that are performed on the territory of an economy. For income, we are rather interested in activities that are exercised by residents with permanent residence on this territory,

whether these activities take place at home or abroad. For disposable income, one is more interested in the persons who earn the income. For the GDP, it is more important, where production occurs. Even for disposable income, however, residents are not defined by their citizenship. Longer-term guest workers in Austria are counted as Austrians, while some border workers, foreign students etc. are not counted as residents.

Again there is a **production account**, which departs from gross output, which is recorded without goods taxes. Goods taxes are those indirect taxes that depend on the quantity of production, i.e. primarily value added tax (VAT) and customs. GDP should however also include these, thus they are added, before intermediate consumption is subtracted. The balancing item is GDP. Net of depreciation, this variable is called *net domestic product* (NDP). GDP and NDP should correspond to the row sums across the values added of all sectors.

Uses	*Resources*
intermediate consumption	**gross output**
gross domestic product	goods taxes – goods subsidies
depreciation	
net domestic product	

In the sequence of accounts, the balancing item of exports and imports according to SNA is recorded in a separate account as *external balance of goods and services*. Otherwise, the *generation of income account* follows, whose balancing item is again the operating surplus and mixed income. Note that the previously added goods taxes are subtracted here just like other taxes, such that the sectorial income accounts are comparable to the total. All subsidies are minus positions (minus items), what really matters is the net

position of taxes minus subsidies.

Uses	*Resources*
wages paid	**net domestic product**
goods taxes paid	
other production taxes paid	
goods subsidies received	
other subsidies received	
operating surplus and mixed income, net	

In analogy to the sectorial account, an *account of primary income allocation* follows here, which yields the so-called *net national income* (NNI) as a balancing item. The NNI should correspond to the sum of primary incomes net across all resident sectors. In the sequence of corrections in the last two accounts (generation of income and primary distribution), the difference between resident production and resident income disappears, such that the resulting NNI again expresses the income of residents, which is indicated by the word 'national'. Before all, the net position of border-crossing property income can be sizeable, while the net position of border-crossing wages and subsidies is comparatively small. In order to calculate '*gross national income*' (GNI), one must add depreciation to net national income. GNI approximately corresponds to the historical 'gross national product' (GNP). The name 'income' for this item is better than 'product', as it describes the income of residential population and not their production.

Uses	*Resources*
property income paid	**operating surplus and mixed income, net**
	wages received
	production taxes received
	– subsidies paid
net national income	property income received

By way of the *account of secondary income distribution*, we obtain the disposable income of the total economy. The positions in this account are relatively small, as only few direct taxes and social contributions cross borders and their net position is even smaller:

Uses	*Resources*
income and property taxes paid	**net national income**
social contributions paid	income and property taxes received
monetary social benefits paid	social contributions received
other current transfers paid	monetary social benefits received
disposable income net	other current transfers received

Like households, also the total economy consumes out of its disposable income. Mainly, the household and the government sectors contribute to this consumption. After an above mentioned small correction due to the change in pension funds, the saving of the economy results as a balancing item. In a parallel account for the non-resident sector, this *use of income account* also shows the external position 'external balance of current transactions'. This is important insofar, as this 'SNA current balance' is available to an open

economy to finance its investment, apart from its saving.

Uses	*Resources*
consumption expenditure	**disposable income net**
saving net	

The *capital account* has again the form that was described above. Finally, the net position of lending and borrowing should correspond to the current external balance. Due to measurement errors, there is no exact correspondence. Therefore, there is the possibility of a 'statistical difference' on the debit side. In total, however, the net position of lending and borrowing for the total economy should be the negative value of the external balance.

Uses	*Resources*
gross fixed investment	**net saving**
– depreciation	capital transfers net
inventory changes	
net acquisition of valuables	
net acquisition of non-produced assets	
net lending/borrowing	

2.3 Variants of GDP

Once more the most important current and historical (partly still used) definitions

- **Gross national income** (GNI, formerly 'gross national product'): GDP plus primary income of residents from the rest of the world minus primary income of non-residents from the economy; a GDP according to the concept of residency of income earners instead of residency of production units. International mobility (work abroad) confuses the

concept (extreme examples Luxemburg, Kuwait). Persons with permanent residence in Austria are always counted as residents!

- **Gross social product**: obsolete expression for gross national income (GNI).
- **Net domestic product**: GDP minus depreciation.
- **Net domestic product at factor costs**: Net domestic product without all production taxes (minus T_{ind} plus $subv$).
- **Net national income** (formerly 'net national product'): gross national income minus depreciation.
- **Net disposable income of the economy**: net national income (at market prices, i.e. including all production taxes) plus balancing item of border-crossing transfers. Should be a future main indicator of the economy.
- **GDP** (etc.) **at basic prices**: Intermediate stage between the calculation at market prices (i.e. including all production taxes) and the calculation at producer prices (i.e. excluding all production taxes). Here, only goods taxes (comprises as its most important parts the value added tax and customs) minus goods subsidies are subtracted. Only after the further subtraction of 'other production taxes minus other subsidies' (e.g., payroll tax), the value at producer prices is obtained. According to convention, the original gross output is compiled at '*basic prices*', GDP and NNI are then shown at market prices.

Factor costs: the compensation paid to the production factors capital (machinery and buildings) and labor, by profits and wages, without taxes (net minus subsidies).

Primary income: defined as income earned by direct participation in the production process. Labor and property income. Formerly 'factor income'.

2.4 SNA=3 national accounts

In many countries, GDP was formerly calculated three times

- **from production**
- **from its final uses**
- **from income**

Particularly in the UK, three slightly different GDP variants were computed. According to SNA convention today, the first of the three defines the proper GDP. As already described, GDP is computed by adding 'goods taxes minus goods subsidies' to gross output and subtracting intermediate consumption. There is also a break-down according to different production sectors (mining, agriculture, manufacturing etc.), which is not of central interest in macroeconomics. An important component of this break-down is *industrial production*, which is computed on a monthly basis and serves as a fast business indicator.

Of fundamental interest in macroeconomics is the break-down of GDP according to *final uses*

$$GDP = C + C_P + I + X - \mathrm{Im} \quad . \tag{1}$$

which is collected in a separate SNA account (**Account 0**, in economics GDP is denoted by the letter Y and government consumption by the letter G). Note that, from the outlined sequence of accounts you obtain C from

the consumer expenditure of households (including NPIsH), C_p from the consumer expenditure of general government, I from the capital account, $X - \text{Im}$ from the external account as an external balance. In order to obtain an exact match of the left side (from production) and the right side (from uses), one should observe:

- the changes in inventories (conceptually seen as investment: inventory investment)
- the change in the stock of valuables (purchases of objects of art etc.) and similar small positions
- a statistical difference (formerly often added to the smaller aggregates as 'inventory changes and statistical difference')

Sometimes, the **private consumption** C is broken down in:

- consumption of durable goods (cars, video recorders, ...)
- consumption of non-durable goods (clothing, food, books and journals, ...): proximity of purchase and utilization
- consumption of services (dining out, fitness studio, ...): not storable

Public consumption C_P is broken down into:

- Collective consumption: indivisible utilization (e.g., street lighting)
- Individual consumption: can be allocated to individual persons (e.g., free education)

According to the concept of the new SNA, individual public consumption and private consumption are summarized in the aggregate 'individual consumption'. The economic meaning of this convention is questionable.

Gross fixed investment I ('gross'=includes depreciation, 'fixed'=no inventory investment; also comprises public investment; in SNA: *gross fixed capital formation*) is broken down into:

- investment in equipment (machinery, vehicles, ...)
- investment in construction (buildings and structures, includes residential construction)

The meaning of the *distribution of income account* for the determination of **disposable income** etc. was already explained. By contrast to many other parts of the SNA accounts, which exist in **real** terms (adjusted for inflation, at constant prices, in the public sector difficult!) and also in **nominal** terms (at current prices), the income distribution is calculated in nominal terms only. An important derived quantity of the distribution accounts is the wage quota, i.e. the share of compensation for labor in national income.

The disposable income of households Y_D serves as the basis for the calculation of the *household saving rate*

$$q_{SH} = \frac{Y_D - C}{Y_D} \quad .$$

In Austria, this quotient currently is around 8-9%.

2.5 Other statistics that are related to SNA

Wealth is a stock variable and notoriously difficult to compile (human capital, unknown value of assets etc.). Household wealth can be estimated from consumer expenditures on durables and assumptions about the depreciation of these durable goods. Data on monetary wealth is provided by banks (checking accounts, saving accounts, bonds, shares). The **capital stock** (stock of produced means of production) results from depreciation rates for

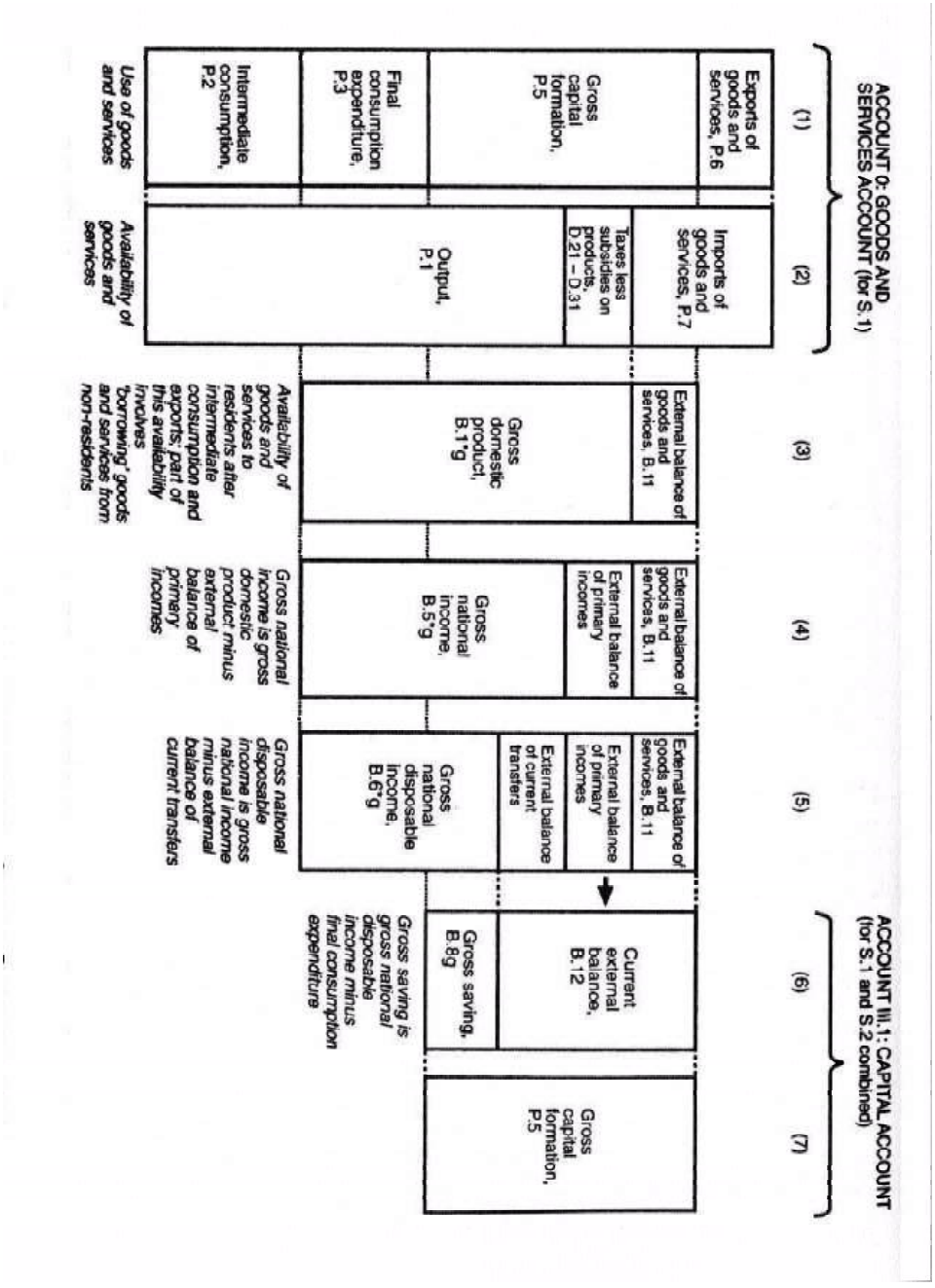

Figure 1: Main components of the SNA (from Dudley Jackson, *The New National Accounts*).

types of capital goods and from gross fixed investment. The **stock of inventories** results from inventory changes etc.

Input-output (IO) tables are large matrix tables that report the flows of goods and services among subsectors of an economy, admit detailed information about intermediary consumption, which is necessary for final production in a certain sub-sector.

The **balance of payments** registers all transactions of goods, services, payments across borders. Because of different concepts, it does not match the SNA balances exactly:

1. goods balance (only goods, in Austria approximately neutral net position)

2. services balance (primarily tourism, in Austria positive net position, and also other services)

3. external balance of primary income (compensation of border workers, primarily border-crossing property income, in Austria passive)

4. external balance of transfers (transactions without counterpart, in Austria passive)

Positions 1–2 together are the so-called '*trade balance*', Position 1–4 yield the *current accounts balance*. The current accounts balance should match, with inverted sign, the balance of capital flows (*capital accounts balance*, short- and long-run capital flows; note the usage of the word 'capital' that does not denote produced means of production here). A difference of the two positions may stem from the change in reserves of currency and gold in the central bank, and from diverse statistical discrepancies. All balances together

are called the *balance of payments*. Therefore, there cannot be a deficit in the balance of payments, while there may be a current account deficit.

Price indexes (*deflators*) must be calculated for the GDP and for all of its demand-side components (durable consumption, total private consumption, construction investment etc.)

Traditionally, deflators followed the concept of the *Paasche index*

$$p_t^{t+1} = \frac{\sum_j p_{j,t+1} x_{j,t+1}}{\sum_j p_{j,t} x_{j,t+1}} \tag{2}$$

(what would the goods now demanded have cost one year ago?). After selecting a special base year, in which real ('at constant prices') and nominal ('at current prices') variables (e.g., GDP) coincide, a current price index evolves from

$$P_t = p_{t-1}^t p_{t-2}^{t-1} \dots p_{t_0}^{t_0+1} P_{t_0} \quad ,$$

where P_t is 1 (or 100) in the base year t_0.

Alternatively, basket indexes are calculated according to the concept of the *Laspeyres index*

$$p_t^{t+1} = \frac{\sum_j p_{j,t+1} x_{j,0}}{\sum_j p_{j,t} x_{j,0}} \tag{3}$$

(by how much did the price of a fixed basket of goods and services increase over the last year?). The basket is modified partly continuously, partly in base years, as goods are continuously replaced by other comparable goods. It is common to standardize the Laspeyres index in the base year at 100, though this standardization plays no role. The most important Laspeyres-type index is the *consumer price index* (CPI), which, e.g., determines the increases of rents and wages.

Since 2004, SNA deflators are no more calculated as Paasche indexes but rather as geometric averages of Paasche and Laspeyres indexes (**chaining**).

A consequence is that identities—such as the important Account 0 identity—do not hold exactly for real quantities any more.

What distinguishes *de facto* the consumption deflator and the consumer price index? With the Laspeyres index, the households stand no chance to substitute goods that have become more expensive by relatively cheaper ones (e.g., books by computer software), therefore the CPI usually increases faster.

hedonic prices: technical products (cars, computers) develop fast. Some experts argue that these should not be valued at the market price, but at the price of their inner characteristics (fuel consumption, speed of calculation). This concept often yields a general decrease in the price of such goods by increase in quality, though the problem remains whether the customers are forced to consume an additional and relatively cheap 'quality' of such goods (tinted car windows, automatically installed software). The concept is partly used by statistical agencies for the calculation of all indexes.

The **rate of inflation** is the percentage change of a price index P_t, i.e.

$$100\frac{P_t - P_{t-1}}{P_{t-1}}$$

where P_t, e.g., may denote the consumer price index. As long as price inflation remains 'normal', the logarithmic rate $100(\log P_t - \log P_{t-1})$ is a convenient approximation and is often preferred for technical reasons.

Labor market statistics provide the important **unemployment rate** on a monthly basis. According to the traditional ('Austrian') definition

$$\text{unemployment rate} = \frac{\text{registered unemployed}}{\text{employed} + \text{registered unemployed}} \tag{4}$$

where the denominator is called the (*dependent*) *labor force*. Here, **self-employed** persons do not count as employed. In contrast, the official unemployment rate ('international definition', ESA rate) relies on census mea-

surement, as registering at employment agencies is not a good indicator for unemployment (no registration, when there is no chance of obtaining benefits or if search is hopeless; fake registration of persons working in the shadow economy) in many countries. According to this convention, self-employed persons are included. In Austria, the 'international' concept leads to a lower rate; in Spain, it leads to a higher rate.

2.6 Critique of National Accounts

1. SNA measures incorrectly

   (a) Measurement and numbers are bad: Critique of reducing the real world to data (atypical for a quantitative science, such as economics)

   (b) SNA does not measure welfare ⇒ social indicators, questionnaires etc. (borderline to sociology)

   (c) SNA measures flows, whereas true wealth is expressed by *stocks* of property and possessions.

2. SNA measures too much

   (a) *regrettable necessities* should not be measured, such as road accidents, criminal activity, expenditures for longer commute to work, as these do not increase welfare: definition of boundaries is difficult, strong consequences for international and intertemporal comparisons unlikely (military goods even now only contribute, if they can also be used for civilian purposes)

   (b) damage to health and the environment should be subtracted. Throw-away goods should not increase wealth ⇒ slower growth if such

concepts are considered tentatively (NORDHAUS/TOBIN: *measure of economic welfare* MEW instead of GDP)

3. SNA measures too little

   (a) economic activities, which do not touch official markets (household work, so-called shadow economy), are not compiled accurately (household work is deliberately excluded, as: (1) it is difficult to measure, (2) externalizing of services in principle even now an indicator of welfare, (3) household services as component of GDP would destroy the differentiation between unemployment and employment; shadow economy *is* included in official GDP, although its assessment is concededly difficult; illegal production is by definition a part of GDP!)

   (b) quality of life, leisure, creation of national parks, cleaning of air and water are not valued sufficiently, as these are not market goods and do not have market prices (task for environmental economics)

3 The goods market

Wherever necessary, it is assumed that households and firms are identical and produce and consume only one good. This good serves as a consumption good as well as an investment good. Demand is assumed to be satisfied immediately by supply at a given and fixed price. The decomposition (Account 0) of national income Y (or GDP, these are assumed as equal in what follows) according to uses

$$Y = C + I + G + X - \mathrm{Im} \tag{5}$$

(consumption C, investment I, government expenditure G loosely corresponds to the C_P from SNA, exports X, imports Im) simplifies to

$$Y = C + I + G \tag{6}$$

in a **closed economy**, which does *not* communicate with the rest of the world by means of imports or exports (as opposed to an open economy). At first, it will be assumed that the economy is closed.

Consumption C: households consume out of their disposable income, we write

$$\begin{aligned} C &= C(Y_D) \\ &\quad + \end{aligned}$$

This is a (for the moment, not exactly specified) **consumption function**. The sign '+' indicates that consumption rises with increasing income and falls with decreasing income, i.e. it reacts 'positively'. A simple functional form is the linear specification

$$C = c_0 + c_1 Y_D \tag{7}$$

with $c_1 > 0$ and typically also $c_0 > 0$. This so-called KEYNES consumption function contains two **parameters** c_0, c_1, i.e. not directly observable, fixed constants. As a **behavioral equation**, it describes the action of households as depending on their income. By contrast, the simplifying relation

$$Y_D = Y - T \tag{8}$$

with taxes T is not a behavioral equation, but rather a **definitional equation** (identity). In more detail, the variable T may be identified with 'income taxes minus transfers from government to households' and may even be thought to comprise social contributions and benefits.

'**Lump sum':** except for some exercise examples, taxes T are assumed to be independent of income. Each identical household pays a fixed amount to the government, a 'lump sum'.

The parameter c_0 is the **autonomous consumption** of the economy. Because the households are all alike, c_0 is the sum of all expenditures of all households that is necessary for their survival, if these *do not receive any income.*

The parameter c_1 is the **marginal propensity to consume** and describes, by how much consumption rises, if households receive an increase in their income by, e.g., one euro. In this case, they increase consumption by c_1 euro. It makes sense to require $c_1 < 1$, i.e. $c_1 \in (0, 1)$. One also writes

$$c_1 = \frac{\partial C}{\partial Y_D} \tag{9}$$

Unlike c_1, the **average propensity to consume**

$$\frac{C}{Y_D} = \frac{c_0}{Y_D} + c_1 \tag{10}$$

is not a constant, but falls with increasing income. C/Y_D answers the question, how much out of the total income is consumed, *not* out of a 'marginal'

additional income. Falling average, but constant marginal propensity to consume was one of the famous KEYNES axioms.

Investment I, **government expenditure** G, **taxes** T: are kept fixed and are, as 'exogenous' variables, not determined in the model; no relationship between G and T; exogenous (determined outside the model) variables act like parameters, though, unlike those, they are observed directly. Formally, one writes:

$$I = \bar{I} \tag{11}$$

$$G = \bar{G} \tag{12}$$

$$T = \bar{T} \tag{13}$$

The behavioral equation (7), the definitional equation (8), and the three identities that express exogeneity (11), (12), (13) describe the aggregate **demand** in the simple closed economy.

The **supply** results from the quantity of the produced good Y.

Equilibrium on the goods market, i.e. a cleared goods market, in which there are no increasing inventories and no unsatisfied and hungry consumers, means that Y and aggregate demand $Z = C + I + G$ are equal, i.e. $Y = Z$, or

$$\begin{aligned} Y &= c_0 + c_1 Y_D + \bar{I} + \bar{G} \\ &= c_0 + c_1(Y - \bar{T}) + \bar{I} + \bar{G} \end{aligned}$$

and thus

$$Y = \frac{1}{1 - c_1}(c_0 + \bar{I} + \bar{G} - c_1 \bar{T})$$

Thought experiments

1. We increase government expenditure $\bar{G}$ by 1 euro. This increases national income Y by $1/(1-c_1)$ euro. Because $c_1 \in (0,1)$, for example $c_1 = 0.9$, Y increases by **more than one** euro, for example by 10 euro.

2. We increase investment $\bar{I}$ by 1 euro. Again Y increases by $1/(1-c_1)$ euro, in the numerical example by 10 euro.

3. We increase autonomous consumption c_0, for example by a campaign of optimism. Again, Y increases by $1/(1-c_1)$ euro.

4. We increase taxes by 1 Euro. Now Y falls by $c_1/(1-c_1)$ euro.

The important value $1/(1-c_1)$ is called the (fiscal) **multiplier**, as it multiplies the increase of an exogenous input in the aggregate output. This multiplier effect is caused by the following mechanism: additional consumer demand leads to an increase in total aggregate demand Z, which is satisfied by the firms immediately, whereby Y increases once more, as income equals production, etc.

Saving propensity and multiplier: If $Y_D - C$ is interpreted as **household saving** S_H, then $1-c_1$ is the (marginal) **saving propensity** of households, if c_1 is a propensity to consume, as

$$S_H = Y_D - C = Y_D - (c_0 + c_1 Y_D) = -c_0 + (1-c_1)Y_D$$

The *bigger* the *saving propensity*, i.e. the *smaller* the *propensity to consume*, the *smaller* is the *multiplier*, and vice versa. At a saving propensity of 1, the multiplier becomes 1, i.e. it does not multiply anything. At a saving propensity of 0, the multiplier becomes ∞. This would be nonsense and must be ruled out.

Empirical evidence (Figure 2): in line with the theoretical concept, the propensity to consume appears to be slightly less than 1. A statistical re-

gression estimation yields a value of $c_1 = 0.89$ and $c_0 = -13$. The propensity to consume is reasonable (on average, households save 11% of their income), while autonomous consumption is not plausible. The reason is that the linear consumption function (7) does *not* fit Austrian data. The linear approximation yields a good estimate for the slope of the curve in the years 1976–2002, but a bad estimate for the behavior at very low national income, for which we do not have observations (and do not want to create any by an experiment!).

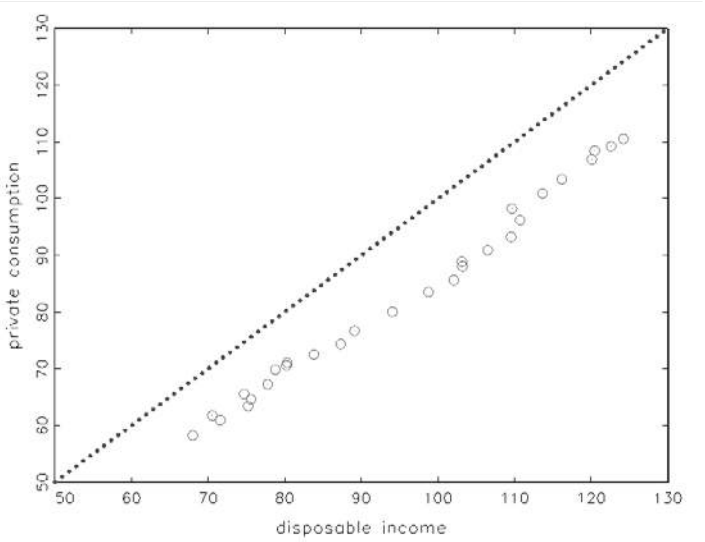

Figure 2: Disposable income and private consumption in Austria, both series deflated by consumer prices, 1976–2003.

The solid line shows $C = Y_D$, which would correspond to a propensity to consume of 1 (at $c_0 = 0$). Actually, in some countries isolated values with $C > Y_D$ were observed, e.g., during an episode of a budget consolidation, though not in Austria.

Saving is investment (the **IS identity**). The saving of households (a *flow*, not 'savings', this could be the *stock* of saving accounts!) is that part

of income that is not consumed

$$S_H = Y_D - C = Y - T - C \tag{14}$$

Noting that $Y = C + I + G$ we obtain

$$S_H = I + G - T. \tag{15}$$

If government runs a balanced budget, then its expenditure G equals taxes T , $G = T$. This implies $S_H = I$, "saving equals investment". If government runs a budget surplus (at the expense of the rest of the economy), then $T > G$ and therefore $I > S_H$. If government consumes more than its revenues (a budget deficit), then $T < G$ and therefore $I < S_H$. If one views $T - G$ as 'government saving' S_P, then

$$S_H + S_P = I \tag{16}$$

Thus, investment equals saving of households *plus* government saving. Typically, S_P will be negative.

Where is the saving of firms? The saving of enterprises corresponds to undistributed profits. In this simple model, it is assumed that (8) holds, households receive the total income minus taxes. In this model, the saving of firms is therefore 0.

Is saving good or bad? (Schoolchildren often learn that saving is a good thing) In the short run, saving has a *contractionary* effect, i.e., a negative effect on output. Lower c_0 decreases aggregate income by $c_0/(1-c_1)$. Lower c_1 has an even stronger negative effect. Because a contractionary effect of saving appears to be a 'paradox', this is sometimes called the **saving paradox** (paradox of thrift, first implication). It can also be shown that, in the model, a decrease of c_0 or c_1 implies such a strong decrease in Y that S_H (which depends on Y) does not change at all (**Exercise**, paradox of

thrift, second implication). In the long run, the saving paradox disappears, as saving increases the growth potential of the economy, causes the interest rate to fall, and increases investment. These mechanisms are absent in the simple model with $I = \bar{I}$. (16) is only an identity and does not describe economic behavior.

Is it preferable to increase government expenditure or to decrease taxes? In the model, a 1 billion euro increase in G at $c_1 = 0.9$ yields an additional income of 10 billion euro, while a decrease of T by the same amount only yields 9 billion euro. G directly affects aggregate income, while T only affects the disposable income and household consumption, whereby saving annihilates a part $1 - c_1$.

4 Financial markets

Many possibilities are available to a household who has to allocate its income. The largest part of the disposable income is consumed, the remainder (7–12%) is 'saved'. For saving, the following 'assets' can be used:

1. **narrow-sense money (cash, currency)**: originally promissory notes on the central bank. Universally accepted for transactions, but bears no interest. **Liquidity** is maximal, **interest rate** is 0.

2. **checking accounts** (demand deposits): short-run assets at banks. Increasingly used for transactions (Quick Cash, Debit Card), very low interest. **Liquidity** is high, **interest rate** nearly 0. Included even in narrow-sense money (M1).

3. **saving accounts** (and time deposits): longer-run assets at banks. Must be exchanged for money to enable transactions (limited liquidity),

but bear interest. Fast exchange for cash with small and standardized transaction costs, therefore included in wide-sense money (M3).

4. **bonds** (risk-free securities with fixed interest): promissory notes at good debtors, can be purchased at banks (brokers). Better interest, must be sold for transactions.

5. **shares**: certificates of shared ownership at corporations. Uncertain, though often good interest (return, dividends). Usually purchased via banks (brokers) at a stock exchange and sold at variable prices.

6. **real estate, stamps, antiques**: uncertain interest, low liquidity (statistically, partly consumption!).

The aggregate stock of these *assets* is the *wealth* of households. Note that household wealth does not contain the stock of consumer durables (cars and dishwashers) with their negative rate of interest due to depreciation. Wealth and its components are *stocks*, which increase by adding the *flow* variable 'income' and diminish by subtracting the flow variable 'consumption'.

Assumption: in the closed economy there are only money and bonds. The problem of households consists in distributing their wealth optimally among money (M) and bonds (B), i.e. to find M and B such that $M + B = \$W$. The symbol '$\$W$' indicates that wealth and its components are measured at current prices (in nominal terms).

4.1 Demand for money and bonds

Demand for money (M^d for *money demand*). Money serves for transactions, whose amount is proportional to national income ($\$Y$ for nominal national income). High income means many transactions. When interest i

on bonds is high, households do not want to forego the additional income out of interest and keep little money. One writes

$$\begin{aligned} M^d &= M^d(\$Y, i) \\ &\quad + \; - \end{aligned}$$

or, more specifically and simpler

$$M^d = \$Y \cdot L(i)$$

with the function $L(i)$, which falls in its argument i. The letter L is for 'liquidity'. At an interest rate of 0, $i = 0$, all wealth is kept as money. At a high interest rate, relatively little money is kept. Thus, one has $i \geq 0$ and $L(i) > 0$.

For fixed income $\$Y$, one sees a falling function (Fig. 3), which is drawn with i on its y axis (ordinate axis) and with M on its x axis (abscissa axis), for technical reasons. The higher $\$Y$, the more do the curves move to their right. At every interest rate i, more money is demanded.

Demand for bonds B^d. This results from the budget constraint and from money demand as

$$\begin{aligned} B^d &= \$W - M^d \\ &= \$W - \$Y\, L(i) \end{aligned}$$

Larger wealth causes an increased demand for bonds, higher interest also raises the demand for bonds. Higher income increases the stock of wealth but also decreases money demand. In the short run, we assume that $\$W$ is exogenous, therefore an increase in income will cause a fall in the demand for bonds.

Empirical evidence for Austria. Figures 4 and 5 show the development of the variables $M/\$Y$ and i during 1970–2004. The theoretical concept

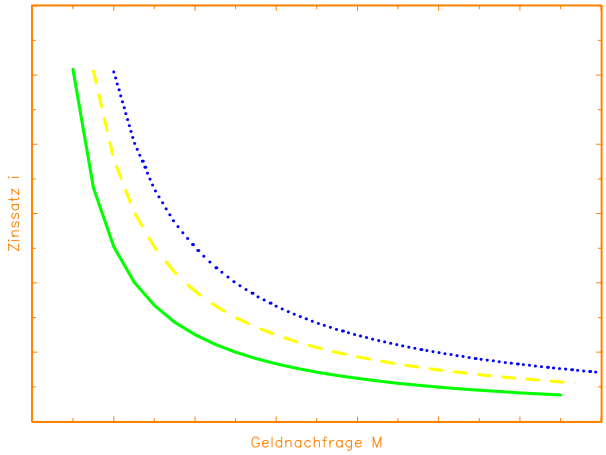

Figure 3: Money demand curves

of a function $L(i)$ would imply a negative relationship, which is partly supported by the time-series graph and by the scatter diagram. There is no convincing evidence on a long-run fall in the ratio $M/\$Y$, which is reported for the USA. Such a long-run fall may be plausible, as today less cash money (including checking accounts?) is used than some time ago. This feature would imply that the inverse ratio $\$Y/M$, the so-called '*velocity of money*', increases.

4.2 Equilibrium in the money market

(Money market is an older expression for the financial market) obtains when money demand equals money supply. Assuming the **money supply** to be fixed and to be determined exogenously by the central bank, equilibrium

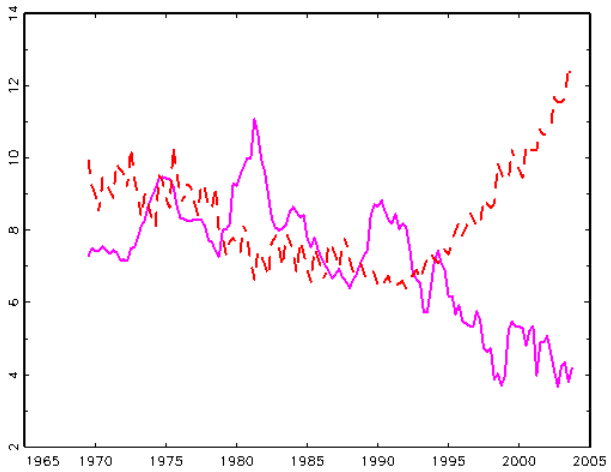

Figure 4: Long-run interest rate on bonds (solid) and ratio of money M1 and nominal GDP (dashed) in Austria 1970–2004.

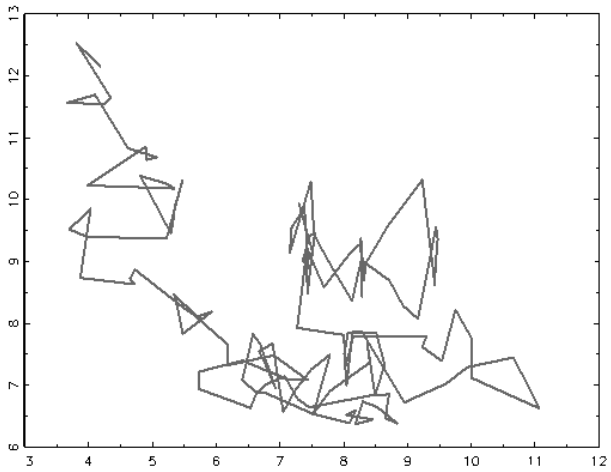

Figure 5: Scatter diagram with the same values as in the last graph.

means

$$\begin{aligned} M^s &= \bar{M} \\ M^d &= \$YL(i) \\ M^s &= M^d \end{aligned}$$

Graphically, the vertical line $M^s = \bar{M}$ intersects the money demand curve at a unique point, which determines the interest rate i. Thus, a given $\bar{M}$ determines i uniquely. The equation $M = \$YL(i)$ is called **LM** identity, which is for 'liquidity is money' and is the counterpart to the IS identity 'investment is saving'. If both the LM and the IS identity hold, there is equilibrium in the goods market *and* in the money market.

Experiments:

1. The nominal income $\$Y$ is increased exogenously, for example by increasing government expenditure. $\bar{M}$ is set by the central bank and does not budge. The money demand curve shifts outward, the equilibrium interest rate i rises.

2. The central bank increases the money supply $M^s = \bar{M}$. The vertical line shifts to the right, the money demand curve does not move. The equilibrium interest rate i falls.

How does the central bank do it? The central bank can use three different tools: open-market operations, reserve requirements, discount rate. In open market operations, the central bank buys or sells bonds or other assets and pays or receives money. It thus increases or decreases the amount of money in circulation. Tightening the reserve requirements leads to tightening of money, similar to an increase of the discount rate. Currently, the most important instrument is open-market policy.

Reserve requirements. Obligatory reserves of banks that are held at the central bank. Formerly, the central bank paid no interest on such monetary reserves. The original intention was to guarantee the banks' savings accounts, today reserve requirements are just means of controlling the money supply. Today, reserves have become interest-bearing (~2%). Thus, this interest rate be used as another instrument of controlling the money supply.

Discount rate. An interest rate for transactions between the central bank and banks. A higher discount rate does not automatically imply a higher interest rate in the money market, though some positive influence is reasonable to assume.

4.3 Price of bonds and interest rate

In real-world financial markets, the interest rate of a bond is not determined directly, but indirectly via the bond price. Assume that a bond is in circulation at time point t, while its owner receives at maturity $t+1$ a value of 100. That is, assume that '100' and the maturity date are printed on the bond. Then, the price of the bond in t, P_{Bt}, determines the interest because of

$$i_t = \frac{100 - P_{Bt}}{P_{Bt}} \quad ,$$

i.e. not in percentage points, e.g., $i_t = 0.07$. Conversely, if i is given, the bond price can be calculated as

$$P_B = \frac{100}{1+i}.$$

Because $i > 0$, it must hold that $P_B < 100$.

4.4 The money multiplier

The stock of printed money H (*high-powered money*) is called **monetary base** and is partly stocked at the commercial banks, partly it is circulating:

$$H = CU + R$$

R denotes the reserves of banks, CU for '*currency*' (cash money). Today, usually 'money supply' is defined as **M1**, the sum of currency and demand deposits:

$$M = CU + D$$

The banks can create money far beyond the monetary base. They face two restrictions:

1. The minimum reserves required by the central bank, which are kept by the banks at low or no interest, lock the ratio $\theta = R/D$ from below.

2. The economic agents determine their own (street-corner shop, newspapers) cash demand coefficient $c = CU/M$.

From the relations, we obtain for demand deposit money D

$$D = M - CU = (1 - c)M$$

and therefore for the monetary base

$$H = CU + R = cM + \theta D = (\frac{c}{1-c} + \theta)D = \frac{c + \theta(1-c)}{1-c}D$$

and thus by inverting the ratio for demand deposit money

$$D = \frac{1-c}{c + \theta(1-c)}H$$

and for total 'money'

$$M = \frac{1}{1-c}D = \frac{1}{c+\theta(1-c)}H \quad .$$

The value $1/\{c+\theta(1-c)\}$ is called the *money multiplier*, as it indicates, by how much the money supply increases, if the central bank prints one additional unit of money. For small c and small θ, the multiplier becomes particularly large.

Example. BLANCHARD assumes $\theta = 0.1$, we further assume that $c = 0.05$ (compare this to your own private allocation between cash and demand deposits!). Then, the purchase of a bond for 1000 euro by the central bank against emission of ten 100 euro notes causes the bond seller to increase his demand deposit by 950 euro, while 50 euro of cash remain in the trouser pocket. The bank keeps 95 euro as reserve and buys bonds for 855 euro from a different bond seller. This bond seller keeps 42.75 euro in cash in the pocket of her jacket, while she increases her demand deposit by 855-42.75=812. 25 euro. Even now, money M1 has almost doubled, but the chain continues and finally leads to 1/(0.05+0.1*0.95) euro, i.e. around 7000 euro, therefore to a sevenfold increase according to the above formula.

How is household wealth really allocated in Austria? Most Austrians do not own shares or stocks, the largest part is still kept in *saving accounts*. The wide-sense definition of money (M3) comprises cash money, demand deposits and also saving accounts. The graph (Figure 6) shows how the shares of these components have developed during the most recent decades.

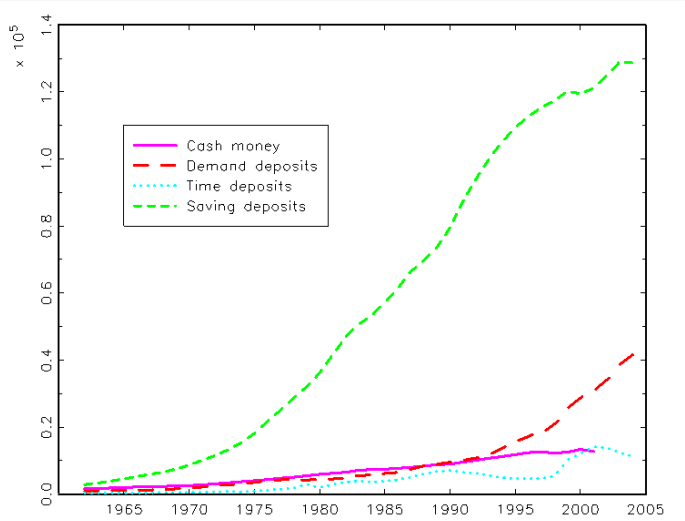

Figure 6: Development of monetary wealth components for the years 1962–2004 in Austria.

5 The IS-LM model

If one looks at the goods and financial markets jointly, then both the equilibrium condition on the goods market (IS) and on the financial market (LM) should hold. In the tradition of KEYNES and HICKS, the emphasis is on the behavior of income Y and of the interest rate i. For this purpose, the model needs a reaction to interest rates on the goods market. Such a reaction is most likely in investment behavior.

5.1 Investment function

The simple assumption $I = \bar{I}$ is now replaced by a useful investment function. Investors react to two important variables:

1. **expected sales** should affect investment plans. These are not known, though observed output Y should be a good indicator for expected sales.

2. the **interest rate** determines the costs of loans that are required to execute investment plans.

It follows that one may depart from an investment function such as

$$\begin{aligned} I &= I(Y, i) \\ &\quad (+, -) \end{aligned}$$

A functional form will, however, not be specified.

Empirical evidence. A systematic negative reaction of gross fixed investment to interest rates is difficult to establish empirically. The graphs show scatter diagrams of the investment ratio I/Y and of its real growth rate against a (nominal) interest rate and only vaguely indicate a negative

relationship. In both diagrams, the most recent value (2002) is in the south-west corner.

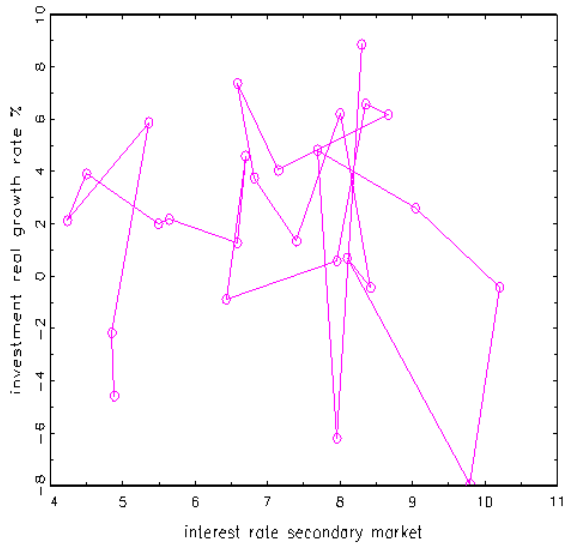

Figure 7: Investment growth and nominal long-run interest rate on bonds 1977–2002.

Investment functions. It is a difficult task to specify good investment functions that are both empirically and theoretically satisfactory. Good consumption functions are easier to find. The important role of expectations will be mentioned in a later section. Note that firms have three sources of financing investment: internal financing out of current profits, loan financing with a 'price' that depends on an interest rate (maybe adjusted for inflation, hence 'real' rate), and new own capital by issuing shares.

5.2 The IS curve

Using the new investment function implies, for demand on the goods market,

$$Z = c_0 + c_1(Y - \bar{T}) + I(Y, i) + \bar{G} \tag{17}$$

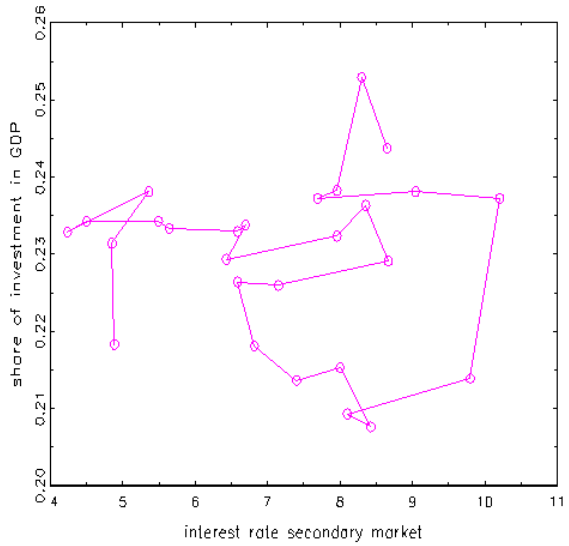

Figure 8: Investment ratio and nominal long-run interest rate on bonds 1976–2002.

and at equilibrium again $Y = Z$. Keeping $\bar{G}$ and $\bar{T}$ fixed, a given interest rate i uniquely determines a corresponding amount of income Y, provided some mathematical assumptions about the form of the function $I(Y, i)$ etc. The curve of all such equilibria in the (Y, i) space is called the **IS curve**. The IS curve is negatively sloped, like a demand curve (quantity of goods depends on price), yet it is *no demand curve*, but rather describes *equilibria in the goods market*. A graphical derivation is found in BLANCHARD (Figure 5-3). A *higher* interest rate i corresponds to a *smaller* national income (output) Y.

The **interest rate i rises**. The demand for investment falls and thus the total aggregate demand in the goods market. In a (Y, Z) diagram, the demand curve $Z = Z(Y, \bar{\imath})$ shifts down, intersects the $Z = Y$ diagonal further left, the intersection point on the demand curve is, however, the equilibrium point. In the IS diagram in the (Y, i)–space, the economy moves *on the IS*

curve leftward, i increases and Y falls.

The **interest rate i falls**. The economy moves *on the IS curve* to the right, i falls, while Y increases.

Taxes T are increased. The demand curve $Z = Z(Y)$ shifts down, without i changing. One obtains a lower demand Y at the same i, the whole *IS curve shifts left*, as one obtains a lower output Y for every given i.

Government expenditure G is increased. The *IS curve shifts right*, as for every interest rate i there is a higher demand Y.

The **autonomous consumption c_0 rises**. Again, the *IS curve shifts* right.

Autonomous demand. Because investment depends on Y and the functional form $I()$ is left unspecified, the positivity of autonomous demand $c_0 + I(0, i) + \bar{G} - c_1\bar{T}$ is not guaranteed, at least not for high interest rates. BLANCHARD argues that positive autonomous demand is the typical case.

5.3 The LM curve

Equilibrium in the financial market obtains if $M^s = M^d$. For money demand M^d we assume $M^d = \$YL(i)$, the money supply is fixed exogenously by the central bank , i.e. $M^s = \bar{M}$. Because the goods market is presented in real terms (deflated, i.e. at constant prices), it is useful to present the financial market likewise. Division by the price level P yields *real money supply*

$$\frac{M^s}{P} = \frac{\bar{M}}{P} \tag{18}$$

and *real money demand*

$$\frac{M^d}{P} = YL(i). \tag{19}$$

Like all simple 'Keynesian' models, our model assumes fixed prices in the short run, i.e. $P = \bar{P}$, therefore there is no change relative to the nominal

presentation. The left side of the equations M/P is called **real money**. In a $(M/P, i)$ diagram, the supply curve is a vertical line. The *real money demand curve* is a downward sloping curve, at a higher interest rate i less money is demanded. The intersection point of the vertical supply line and falling demand curve yields the equilibrium interest rate i. On the money demand curve, Y is kept constant. If Y falls, then the money demand curve shifts left, the equilibrium interest rate i falls. This implies a curve of equilibria in the financial market in the (Y, i) space, the **LM curve**. The LM curve is positively sloped, like a supply curve (supplied quantity of goods dependent on price). It is, however, *no supply curve*, but rather describes *equilibria in the financial market*.

[observe four graphs: supply and demand in the goods market (Keynesian cross), IS curve, supply and demand in the financial market (money market cross), LM curve]

The **interest rate i rises**. *On the LM curve* in the (Y, i) space, one moves to the right, therefore the equilibrium income Y increases. In the money market cross, one observes the following. If i increases, a wedge of disequilibrium opens, as less money is demanded than supplied. Only if income (output) Y increases, the money demand curve shifts to the right until equilibrium is again obtained.

Money is printed. The increase of money supply shifts the money supply vertical to the right, the equilibrium interest rate i falls, without any change in Y. Because for every Y there is now a lower i , the *LM curve shifts* to the right.

The **price level P rises**. This implies a fall in real money supply, expressed by the vertical line $M^s = \bar{M}$. For every Y this yields a higher i, and therefore the *LM–curve shifts* left. The reaction is easier to see from a nomi-

nal (M, i) diagram. The vertical money supply line remains fixed, the money demand curve shifts right, as $\$Y$ rises. Therefore, a higher i corresponds to the same real income Y.

5.4 Fiscal policy in the IS-LM model

Fiscal policy is any economic policy by the government that concerns a change in government expenditure G or in government revenues T. In order to reduce a budget deficit (consolidation), either G can be lowered (less expenditures, difficult) or T can be increased (tax increase, introduction of new taxes, less difficult). Both cases are summarized as **restrictive fiscal policy**. In order to stimulate demand, the government may decrease taxes or increase expenditures. This is called **expansionary fiscal policy**. The expression 'restrictive' is more neutral than 'contractionary', as occasionally a restrictive policy may avoid contractionary effects on output.

In its narrow sense, the **IS-LM model** is the cross that consists of the IS and LM curves in the (Y, i) plain. A change in the exogenous variables or in the parameters shifts one or both curves, and a new equilibrium is generated for both markets, a new point (Y, i). Typically, interest focuses on the question whether the change has resulted in a rise or fall of i or Y (**comparative statics**). More complex is the answer to the question, how the economy moves from the old to the new equilibrium and how long it takes (**dynamics**).

Government raises taxes T. The IS curve shifts left, as described before. The LM curve does not budge, as T does *not* occur in the money market model. Therefore, a new equilibrium to the left and below the old one is obtained. Y and i must both fall. Comparative statics is clear. One can only surmise the dynamics. With regard to Y, the immediate effect runs via

the consumption of households $C = c_0 + c_1(Y - T)$ and lowers Y somewhat. Only then do the investors adjust $I = I(Y, i)$ to the decreased Y and the consumers will also decrease C. During this episode, the financial markets should be quick enough to adjust to all changes immediately. Therefore, one may assume, that the economy moves *on the LM curve* to its new equilibrium. From the beginning, the investors do not only react to the lower Y, but also to the low i. These effects are partly ambiguous, though one may assume that, on the whole, a contraction will lower the goods demand curve. A summary of the steps:

1. Government raises T and lowers disposable income Y_D.
2. Households decrease consumer spending C, aggregate income Y drops.
3. Money demand curve shifts, interest rate i falls.
4. Investors show ambiguous reaction, as i is lower, but so is Y. Consumers feel lower Y_D, as Y has dropped, and reduce consumption C. Aggregate income (aggregate demand) Y falls again.
5. Steps 3 and 4 are repeated, until the new equilibrium is obtained.

Critique. It could be that the contractive fiscal policy generates additional investment demand, as firms substitute the activities of government (*crowding-in* and *crowding-out*). This effect does not show in the model and could mitigate the leftward shift of the IS curve.

5.5 Monetary policy in the IS-LM model

Monetary policy is the policy of the central bank, which by law acts separately from the government and, for example, may increase the money supply

(expansionary monetary policy) or may decrease it (restrictive or contractive monetary policy). The question whether monetary policy or fiscal policy is more important (more efficient), used to be one of the more controversial topics of economics.

The **central bank increases money supply**. The LM curve shifts to the right, as described. The IS curve remains fixed, as our goods market model does not contain the money M. A new equilibrium is created, at a lower interest rate i and a higher output Y. Thus, the comparative statics is obvious. Regarding dynamics, one could imagine the following steps:

1. The central bank increase M^s and thus M/P. The interest rate i reacts strongly and falls, as Y does not react immediately.

2. Firms increase their investment $I(Y, i)$, and aggregate demand Y increases.

3. Money demand increases and therefore the interest rate rises, but less strongly than it dropped before.

4. The higher aggregate demand Y increases consumer expenditure and investment.

5. Steps 3 and 4 continue to the new equilibrium.

This mechanism would lead to a movement from a curved path from the old to the new equilibrium *beneath* the IS curve. However, if all market participants know the new equilibrium, it could be that the economy really moves along the IS curve, just as it is depicted in the text book. This shows that *expectations* of market participants can play an important role.

Mix of monetary and fiscal policy. A smart government could, in agreement with the central bank, use *both* instruments simultaneously, for ex-

ample a restrictive fiscal policy and an expansionary monetary policy. Then both the IS *and* the LM curve shift, with clever coordination an unchanged output Y may be obtained at a lower interest rate i. The literature calls this a *policy mix*.

Does the *policy mix* really work so well? If the same output is obtained at a lower interest rate, there is a danger of inflation, as in the longer run P is no more exogenous and constant. The central bank, which by law is obliged to be concerned about inflation, could refuse to execute an expansionary monetary policy.

Empirical examples. BLANCHARD considers US economic policy in the 1990s, when restrictive fiscal policy and expansionary monetary policy led to a balanced budget and good economic growth, but also German economic policy during re-unification, when expansionary fiscal policy and restrictive monetary policy caused a recession.

6 The labor market

Together with the goods and financial markets, the labor market, as a third market, completes the (open or closed) economy. While inventories in the goods market are often kept deliberately and financial markets move to their equilibria quickly, the labor market seems to be in a state of persistent disequilibrium, as there are **unemployed** persons who, though willing to supply labor, do not find a corresponding demand.

Supply and **demand**: Contrary to the goods and financial markets, where supply comes from the mighty firms or the powerful central bank and the demand side are the small households, in the labor market the suppliers are the households and demand comes from the firms (and the government). In more detail, supply of labor comes from all persons in the *labor force* (labor supply, work force). The share of the labor force in the active population (definitions vary, e.g., resident population from 15/18 and 65) is called the (labor) **participation rate**. The narrow-sense *labor force* (*dependent labor force*) is determined by the *total labor force* minus the *self-employed workers*. The quotient of unemployed (=*labor force* minus employed persons) and *labor force* is the **unemployment rate**, which today is mostly measured by census methods. The **wage** is the price of the good 'labor' on the labor market.

Austria. The unemployment rate amounts to, according to various methods of measurement, around 4–7% and presently appears to be relatively constant after a long and steady increase. A stock of around 200,000 unemployed (in winter more, in summer less) corresponds to a flow of 40,000–50,000 persons, who become unemployed within every month or (while hitherto unemployed) find an employment (or reach the age of retirement, though these are relatively few). For the USA, the share of 'fluctuation' (inflow, outflow) in the unemployed is higher (>1/3). If the Austrian participation rate is

measured only from the dependent labor force, then it shows a long-run increasing trend and is higher than in the European south, though lower than in the north Europe. Since 1954, it has increased from 49% to 63%. There are several conflicting trends: increasing participation by women, decreasing participation due to longer education, and formerly 'self-employed' farmers joining the dependent labor force. Inclusive of the self-employed, participation has remained almost constant at slightly above 70%.

The economically active population (some older statistics use the slightly misleading wording '*able-bodied population*', though fortunately most handicapped are also economically active) amounts to around 5.3 million persons. Thereof, almost 3.8 million persons belong to the labor force. After subtracting 380,000 self-employed, 3.4 millions remain for the proper (dependent) *labor force*, out of which more than 3 million are employed in dependent labor. Not all persons in the resulting difference are unemployed, however, as around 100,000 must be subtracted as soldiers or on leave for childcare etc., in order to calculate the unemployment rate. According to Austrian definition, this rate evolves from dividing the around 230,000 unemployed by the *labor force*.

6.1 Wages

The assumption that all workers are equal (the labor force is homogeneous) is unrealistic, though it is helpful in macroeconomic theory. The wage (compensation for labor) is determined from the *bargaining power* of labor, which is weakened by unemployment (excess supply of labor) and possibly strengthened by membership in trade unions (*unionization*) and unemployment insurance. Because workers want to use their wage to consume goods from the goods market at market prices, they are not so much interested in a high

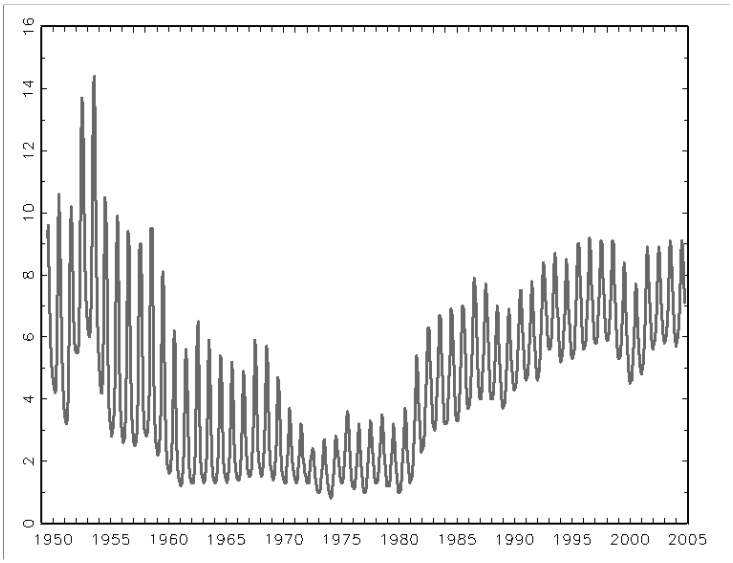

Figure 9: Austrian unemployment rate according to its traditional definition.

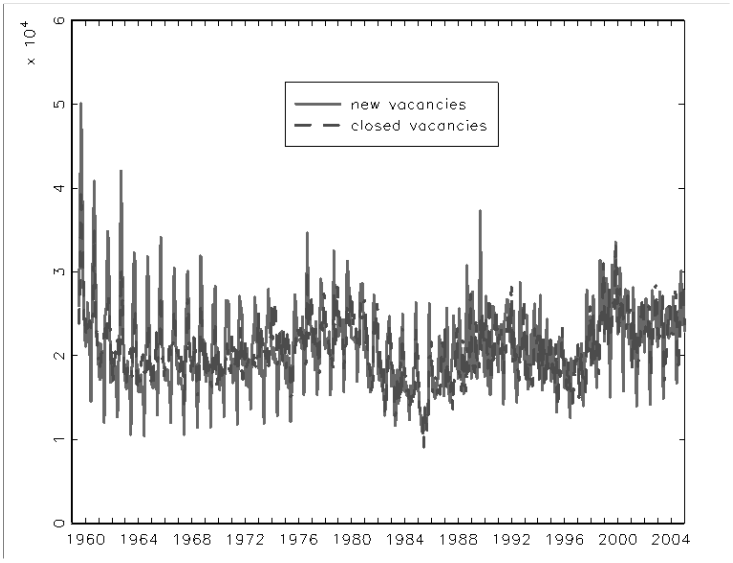

Figure 10: Inflows to and outflows from the stock of job vacancies in Austria indicate the inflows and outflows from the stock of unemployed.

nominal wage W (money wage) as in a high **real wage** W/P.

The **reservation wage** is a wage rate, below which an unemployed person is not willing to supply labor (a person unwilling to supply labor is not necessarily just lazy; consider the fixed costs of employment, such as discipline, clothing, costs of commute etc.). Even for a homogeneous work force, firms often tend to pay *higher* wages than the reservation wage or a legally determined **minimum wage**, in order to tie workers to the firm, to avoid search costs, to enjoy the production effects of firm-specific training costs, and to prevent *shirking* (sloppy work, bad workers' morale). Such wages are also called efficiency wages.

Efficiency wages. BLANCHARD's definition of efficiency wages is a bit unclear, as he introduces them as 'linking wages to productivity', which is a general characteristic of all wages, as will be visible from the price-determination mechanism below. The point is that workers' productivity is assumed to depend positively on their wages. This could explain why employers in some industries pay workers more than employers in other industries do, even if the workers have *apparently comparable* qualifications and jobs. [from a web dictionary]

As a **wage function**, one could use

$$W = P^e F(u, z) \tag{20}$$

where P^e denotes the *expected* price level in the goods market, u is the *unemployment rate*, z is used for 'other influential variables in the labor market' (BLANCHARD's *catchall* variable), and the function F represents *bargaining power*. The catchall z summarizes various effects. For example, increased fluctuation to and from unemployment reduces the fear of unemployment, even at rather high u, as it appears to be easier to find a job. Similarly, unionization and unemployment insurance are expressed in z. Because the

wage is fixed in negotiations for a considerable time span (there is no continuous bargaining process), W/P^e is the *expected real wage* for the immediate future. The function F is *falling* in u (unemployment weakens bargaining power).

6.2 Prices

In Keynesian short-run models, prices are fixed and exogenous. If wages are set, we must also be able to determine prices. If there is competition, a main role is played by the **production function**, which indicates which amount of input of production factors generate which amount of output. At first, BLANCHARD uses the simple production function

$$Y = AN \quad , \tag{21}$$

where N is the labor input ('employment') and A is **labor productivity**. $A = Y/N$ indicates, how much output can be produced with one input unit of labor. In the last 100 years, the ratio A has increased by a multiple. In order to simplify the calculation, one may set $A = 1$ in the following, for example by re-defining the unit of produced goods.

At perfect competition (microeconomics), it is known that prices and wages must correspond to the marginal product of labor $\partial Y/\partial N = A$. From this one may derive that $W = AP$ (*per capita* wage = price per unit of output $\times$ goods produced by one worker) or $W/P = A$ (real wage = labor productivity) or even $P = W/A$ (price = wage per unit of output). In real-life economies, however, producers succeed in adding a **mark up** μ to wage costs, such that

$$P = (1 + \mu)W/A \quad .$$

Here, W/A would be the wage rate per unit of produced good at competition, as a worker produces A goods. μ can be viewed as a measure for the 'market power' of firms, or as a compensation for other 'production factors' (capital, energy, land). The simplifying assumption that $A = 1$ yields $P = (1 + \mu)W$.

6.3 Prices and wages in equilibrium

In a $(u, W/P)$–diagram, one can draw the solution curve for the wage determination equation

$$\frac{W}{P} = F(u, z)$$

for exogenous (fixed) z and for the assumption $P = P^e$ (price expectations are fulfilled!). As already explained, this is a falling curve (in fact, it is a *labor supply function*, which is positively sloped but drawn as negatively sloped, as instead of employment the x–axis shows the unemployment rate u). In this $(u, W/P)$ diagram, the price determination equation

$$\frac{W}{P} = \frac{A}{1 + \mu}$$

appears as a horizontal line (in principle, a *labor demand function*, which should be negatively sloped or, in our diagram, positively sloped, but due to the very simple production function with constant 'returns to scale' is flat).

The intersection of both curves implies an equilibrium real wage and an equilibrium unemployment rate u_n. This unemployment rate is called the **natural unemployment rate**, though it is no constant of nature, but is rather determined by variables and parameters that express market power or the technology, such as z and μ. Although wages and prices are in their equilibrium, there is unemployment, i.e. the labor market does not 'clear'.

Natural employment N_n is given by

$$N_n = L(1 - u_n)$$

if L denotes the *labor force*. Because of $Y = AN$, there is also a **natural output** Y_n, determined from

$$F(u_n, z) = F(1 - \frac{N}{L}, z) = F(1 - \frac{Y_n}{AL}, z) = \frac{A}{1+\mu}$$

or, using the simplifying assumption $A = 1$

$$F(1 - \frac{Y_n}{L}, z) = \frac{1}{1+\mu} \quad ,$$

which determines Y_n implicitly. Therefore, the natural output is that output, at which there is natural unemployment and wages and prices are in equilibrium.

Is there an equilibrium in the labor market? In the interpretation of BLANCHARD's textbook, the labor market is in equilibrium whenever price and wage determination coincide and when there is natural unemployment. Thus, in the short run the labor market is in a disequilibrium, in the medium run it tends to its equilibrium. Alternatively, one might define short-run equilibria at unemployment rates different from the natural rate, or one may argue that the market is in equilibrium only when there is no unemployment, excepting short episodes of job search. The text book uses a possible compromise.

Does labor productivity A affect the natural unemployment rate? In the price determination equation, higher A clearly raises the real wage that firms are willing to pay. If the function $F(u, z)$ remains constant, u will decrease and the real wage increases. However, it is likely that A affects the bargaining function, as workers demand for their share in the added value of the productivity increase. In this case, u_n will re-increase, maybe right to its former value. However, this is not a coercive consequence of the model, as $F(u, z)$ has been introduced simply as bargaining power and not as labor supply.

Which economic variables affect the natural unemployment rate?
Remembering that u_n is defined implicitly as the solution of

$$F(u_n, z) = \frac{A}{1+\mu},$$

we see that u_n is determined by: the markup μ, the catchall for factors determining bargaining power z, the form of the bargaining-power function F, and possibly productivity A. Conversely, no other economic variables appear in this condition, such as: fiscal policy, monetary policy, consumer sentiment, inflation and prices. The natural rate u_n is immune to any change in any of these macroeconomic conditions.

7 The three markets jointly: AS and AD

Idea: The IS-LM model describes the *short-run* equilibrium on the goods market and financial market, which presupposes that prices P are fixed and that the short-run demand for goods creates its supply at current prices ($Y = Z$). In the longer run, prices may move. The short-run equilibrium $\tilde{Y}$ of the nominal IS-LM model in the (Y, i) diagram need not coincide with the 'natural output' Y_n of the labor market. In the longer run, falling or rising prices cause $\tilde{Y}$ to converge to Y_n. BLANCHARD calls the stage that is attained in this section the '*medium run*', in order to reserve the name '*long run*' for growth models.

In detail, BLANCHARD's models use *four* different time horizons:

1. In the *shortest run*, prices P are fixed and thee price and wage determination in the labor market plays no role. Demand creates its own supply, the narrow-sense IS-LM scheme holds.

2. In the *short run*, prices, wages, and employment may move but do not necessarily coincide with their expectations P^e. This time horizon is treated by the AS-AD scheme. The goods supply is flexible, though not entirely 'endogenous'.

3. In the *medium run*, all expectations regarding prices are fulfilled. Natural employment and natural (potential) output determine an invariant equilibrium. The goods supply is fixed.

4. In the *long run*, all determinants for the natural output are changeable. This long run is the subject of *growth theory*, which, e.g., wants to explain growth and welfare differentials between OECD and developing countries.

7.1 The aggregate supply: the AS curve

AS is for *aggregate supply*. In the labor market, equilibrium is defined by

$$\begin{aligned} W &= P^e F(u, z) \\ P &= W(1+\mu) \end{aligned}$$

($A = 1$ is retained). Inserting the first into the second equation yields

$$P = (1+\mu)P^e F(u, z) = (1+\mu)P^e F(1 - \frac{Y}{L}, z) \tag{22}$$

For fixed μ, P^e, z, L (and A), this defines a functional relation between P and Y. For general A, one obtains

$$P = \frac{1+\mu}{A} P^e F(1 - \frac{Y}{AL}, z) \quad .$$

Is this function increasing or decreasing?

If Y rises, there will also be higher employment $N = Y$ (or, for the more general form $Y = AN$ analogously $N = Y/A$), therefore the unemployment rate u falls, hence the functional value $F(u, z)$ increases, as F is a falling function of u (bargaining power). Thus, P rises. The function defined in (22) is also increasing in a (Y, P) diagram. It bears the name **AS curve** and describes short-run equilibria in the labor market. It can, however, also be interpreted as the quantity that is produced and supplied at a given price P using the required amount of labor, when it is read inversely, with Y as a function of P. Therefore, it is a genuine supply curve.

Attention: the AS curve derived here contains characteristics of imperfect markets, such as unsatisfied price expectations and mark-ups. Without these characteristics, the equilibrium output would not depend on price and the AS–curve would be vertical. Some economists think that the long-run (BLANCHARD: medium-run) AS curve indeed is vertical. This 'long-run AS

curve' corresponds to the line $Y = Y_n$. It will be shown that this is the only longer-run equilibrium indeed.

The natural unemployment solves the AS curve for $P = P^e$. If prices equal their expectations, it holds that

$$P = \frac{1+\mu}{A} PF(1 - \frac{Y}{AL}, z)$$

or

$$F(1 - \frac{Y}{AL}, z) = \frac{A}{1+\mu} \quad ,$$

which was the definition of natural output Y_n. Similarly, $1 - Y_n/(AL)$ defines the natural unemployment rate. The point (Y_n, P^e) lies on the AS curve for exogenously givens P^e. From this and the positive slope of the AS curve, it follows that:

1. If $Y > Y_n$, then $P > P^e$, or *vice versa*. Therefore, an 'unnaturally' large output can be attained only when prices are higher than expected.

2. If $Y < Y_n$, then $P < P^e$, or *vice versa*. Therefore, an 'unnaturally' low output occurs if prices are lower than expected.

7.2 The aggregate demand: the AD curve

The IS-LM model

$$\begin{aligned} Y &= C(Y - T) + I(Y, i) + G \\ \frac{M}{P} &= YL(i) \end{aligned}$$

implies, for a given price P, a uniquely defined Y. If one increases P, then the LM curve shifts leftward (already shown), such that higher prices imply a higher i and a lower Y. Higher P therefore implies less output Y, as the

increased interest rate negatively affects investment demand and, by way of the multiplier effects, decreases Y even further. Conversely, lower P means higher output Y, due to the stronger investment and the multiplier effect. In summary, one gets a *falling curve* in the (Y, P) diagram, the **AD curve** (*aggregate demand*). It is a genuine demand curve, as it describes (seen inversely) the quantity in the goods market that is demanded at a given price.

The negative slope of the AD curve is unequivocally accepted among economists. For a given functional form and under certain assumptions, it is mathematically feasible to solve the LM identity for the interest rate, to substitute i in the IS function and then to solve for Y. In short, this implies

$$\begin{array}{rcl} Y & = & Y(\frac{M}{P}, G, T) \quad , \\ & & \quad + \quad + - \end{array}$$

as it is used by BLANCHARD. The prices are influential only by way of the real money M/P. As M/P has a positive influence on Y, the price level in the denominator has a negative effect on output, just as it should be.

7.3 Movements in the AS-AD world

What happens if $\tilde{Y}$ at the intersection point of AS and AD exceeds Y_n? The labor market is not in its medium-run equilibrium, as u is less than the natural u_n. The price expectations are not fulfilled, $P > P^e$. By a mechanism that is *not described in the model*, price expectations adapt to actual prices. In the diagram, the AS curve experiences an upward shift. (A possibility for a formal derivation would be the specification $P_t^e = P_{t-1}$ suggested by BLANCHARD.) In the model, one might assume the following sequence of events: higher wages are demanded; higher wages imply higher

prices via the markup ('wage-price spiral'). An upward movement occurs on the AD curve. Output has fallen, prices have risen. The game continues, until Y_n has been attained. There, the labor market is, at $P = P^e$, in its medium-run equilibrium.

What happens if an expansive monetary policy is pursued? We know that this leads to a lower i and a higher output Y. Because a higher output is implied at every P, the AD curve shifts to the right. Therefore, in the AS-AD diagram, output and prices increase. Because of $Y_n < \tilde{Y}$, there is a pressure on the labor market to further increase wages and prices, and thus formally to shift up the AS curve. As in the previous point, this development stops when $\tilde{Y} = Y_n$. Prices have, however, risen permanently, in 2 phases.

What happens if an expansive fiscal policy is pursued? Just the same, except that, at first (in Phase 1), the interest rate rises instead of falling. This 'washes out' private investment, and this feature continues to work in Phase 2, when the AS curve shifts and prices increase once more. Output finishes again at Y_n, though with lower investment and higher G. A similar effect is achieved by expansive fiscal policy via a tax cut, because of the reaction of interest rates. Finally, output is at the same level as before the tax cut, but investment has fallen and private consumption has increased, and so has the price level.

What happens at restrictive fiscal policy? For example, assume that government lowers its expenditure G. At first, this causes a contraction, leading to lower Y at lower interest rate i. In the AS-AD diagram, the AD curve has shifted left, P and Y have fallen. Because $\tilde{Y} < Y_n$, there is higher unemployment than u_n, wages and prices are reduced, the AS curve shifts down. Wages and prices fall, until $\tilde{Y} = Y_n$ is attained. A lower price level is obtained, at lower government expenditure. G has been substituted by

investment, which has increased because of the lower interest rate .

Conclusion. Expansionary policy can only be successful in the short run. In the longer run, both fiscal and monetary policy are neutral with respect to income. Contractive fiscal policy can have beneficial longer-run effects, such as balancing the government budget and creating positive incentives for private investment. How long it takes, until the economy will return to its 'natural output', cannot be stated exactly, a cycle of several years appears to be realistic. During that phase, an expansive policy causes output to be *actually* higher than natural output, thus economic policy has real effects.

Exogenous change of supply parameters. Both fiscal and monetary policy cause, at first, shifts in the AD curve, which are neutralized in a 2. phase by an opposite movement of the AS curve. As an example for an autonomous shift of the AS curve, BLANCHARD names the OPEC shocks of the 1970s, which he interprets as an increase in the markup μ. The upward shift of the AS curve yields a decrease in Y at increasing prices. The graph tells us that $\tilde{Y}$ has not sufficiently fallen to match the new and much lower natural output Y_n. The disequilibrium in the labor market leads to a further reduction of output at increasing prices, until $\tilde{Y} = Y_n$.

For an exogenous change of price expectations P^e or of the bargaining position of labor suppliers z, one should be able to see similar movements. In this case, the natural output changes, permanent effects occur.

Business cycles (*business cycles*, brit. also *trade cycles*) are fluctuations in output that may be caused by diverse 'shocks' to aggregate supply or demand. The idea is that output moves from peak to trough ('recession', red light) and then from trough to peak ('recovery', green light), around an unknown equilibrium or potential output. Contrary to their name, these fluctuations are irregular rather than strictly cyclical.

8 The Phillips curve

In 1958, the economist PHILLIPS drew, for British data, a (u, π_w)–diagram with wage inflation on the y–axis. The diagram showed a strong negative correlation. Historically, the first report on such statistical relationships is ascribed to IRVING FISHER. Instead of wage inflation π_w, later authors used price inflation π and obtained similar patterns. Such a negative relation can be derived from the AS curve

$$P = (1 + \mu)P^e F(u, z)$$

where, e.g., $P^e = P_{t-1}$, i.e. expected prices equal those of the previous period (of last year). We know that $\partial F(u, z)/\partial u < 0$. By way of several mathematical approximation steps, one may derive that

$$\pi_t = \mu + z_t - \alpha u_t$$

with $\alpha > 0$, or, at positive inflationary expectations π_t^e, also

$$\pi_t = \pi_t^e + \mu + z_t - \alpha u_t \tag{23}$$

[The original PHILLIPS curve was no linear function; PHILLIPS did not seriously consider this possibility!] Such functions are also called 'modified Phillips curves', more exactly 'expectations-augmented Phillips curves'.

Derivation by linearization: Putting $F(u, z) = 1 + z - \alpha u$ yields for $P_t^e = P_{t-1}$

$$\begin{aligned} \frac{P_t}{P_{t-1}} &= (1 + \mu)(1 + z_t - \alpha u_t) \quad , \\ \pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} &\doteq \mu + z_t - \alpha u_t \quad . \end{aligned}$$

Here it is assumed that $\mu, z, \alpha u$ are 'small', such that all products of such terms can be ignored, which justifies the approximative '$\doteq$' For general P_t^e,

one has analogously

$$\begin{aligned} \frac{P_t}{P_{t-1}} &= \frac{P_t^e}{P_{t-1}}(1+\mu)(1+z_t-\alpha u_t) \quad , \\ \pi_t &\doteq \pi_t^e + \mu + z_t - \alpha u_t \quad . \end{aligned}$$

Here the *expected rate of inflation* π_t^e is defined by $(P_t^e - P_{t-1})/P_{t-1}$, i.e. by the inflation that is expected in $t-1$ for t. In the following '$\doteq$' will simply be replaced by '=', which is justified, as the form $F(u,z) = 1 + z - \alpha u$ was assumed arbitrarily.

Conclusion: The rate of inflation π_t tends to rise at higher **inflationary expectations**, as the wage earners demand for a higher wage rise, to compensate the price increases; it also rises at a higher **markup**, as then firms will even add more to wages; it falls with higher **unemployment**, as the bargaining power of workers drops; many more factors z affect this relation.

Evidence: While, for many years, the curve appeared to fit the data well, it broke down in the 1970s (at least, this is what the text books say). FRIEDMAN explained this disappearance by several factors :

1. The OPEC price shock led to additional inflation that was not rooted in the price-wage spiral of the home economy. This implied high inflation at rather high unemployment.

2. A closer view of the modified Phillips curve reveals that a negative relationship is only possible when $\pi_t^e \neq \pi_t$. For 'rational' inflationary expectations $\mathrm{E}_{t-1}\,\pi_t = \pi_t^e$, π_t and π_t^e only differ by an unsystematic error, the values of u cluster around a 'natural unemployment rate', notwithstanding the level of the (on average, correctly expected) inflation. Trade unions, firms, wage earners learn sooner or later, how to form expectations rationally.

3. The popularity of the PHILLIPS discovery may have seduced governments into exploiting this statistical relationship as a *trade-off* between the evils of inflation and of unemployment, e.g., into increasing inflation in an election year, in order to lower u and to optimize the outcome of elections. FRIEDMAN has shown that this is possible only if permanently $\pi_t > \pi_t^e$, which must lead to very high inflation, as it was indeed observed in the later 1970s.

Evidence for Austria. Figure 11 shows the PHILLIPS curve for Austria 1955–2004. It is indeed negatively sloped, though one recognizes several subsamples with different slopes, for example for the years 1960–1980 and 1990–2004. Possibly, several lesser factors (z) implied different 'natural unemployment rates' for each of these periods.

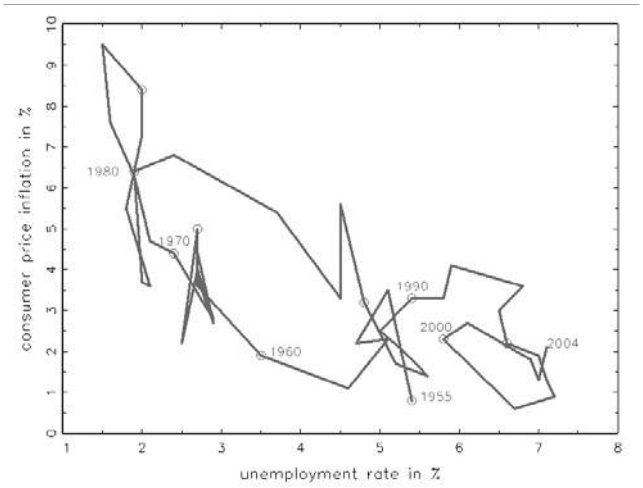

Figure 11: Phillips curve for Austria 1955–2004. Traditionally defined unemployment rate and logarithmic rate of inflation for the consumer price index (concatenated).

If price expectations are formed simply from $\mathrm{E}_{t-1}\,\pi_t = \pi_{t-1}$, then the

(modified) Phillips curve implies the relationship

$$\pi_t = \pi_{t-1} + \mu + z_t - \alpha u_t$$

and one obtains a relation between changes in the rate of inflation and unemployment rate

$$\pi_t - \pi_{t-1} = \mu + z_t - \alpha u_t \tag{24}$$

This function, which is in the focus of the text book and which is called the 'accelerating PHILLIPS-curve', is not satisfactory either, as a long-run stable variable (u) is equated with the growth rate of inflation. Then the rate of inflation would behave like a 'random walk', i.e. like a stock price, which is not plausible. If one trusts in (24), one sees that there is a value of u, for which the right side equals 0. Because price expectations are satisfied for the natural unemployment rate u_n, it must also hold that $\pi_{t-1} = \pi_t$ and therefore u must equal u_n. Therefore, u_n is also called the **NAIRU** (*non-accelerating inflation rate of unemployment*), as for this value the inflation does not accelerate. In theory, the form of the accelerating PHILLIPS-curve implies a NAIRU of

$$u_n = \frac{\mu + z}{\alpha} \quad .$$

Because, however, z is only a catchall variable without known numerical value, one cannot really calculate the NAIRU from this formula. Adepts of this specification can explain changes in the NAIRU by changes in the mark-up μ or in the bargaining power of workers z.

Note. The NAIRU formula $u_n = (\mu + z)/\alpha$ coincides with the natural rate u_n as determined from $F(u, z) = 1/(1+\mu)$, if one uses the approximation $1 - \mu = 1/(1 + \mu)$, which is valid for a small mark-up μ.

Empirical evidence. For Austria, the accelerating PHILLIPS curve leaves a rather sad impression. A systematic negative relationship is not visible. Note the year 1984, when the rate of inflation experienced a strong short-term increase because of an increase in the value added tax rate on luxury goods. A medium-run constant NAIRU cannot be calculated from such data. Some economists assume stronger fluctuations in the NAIRU (in the BLANCHARD model, such fluctuations would follow from changes in μ and z), which however weakens the significance of the whole concept.

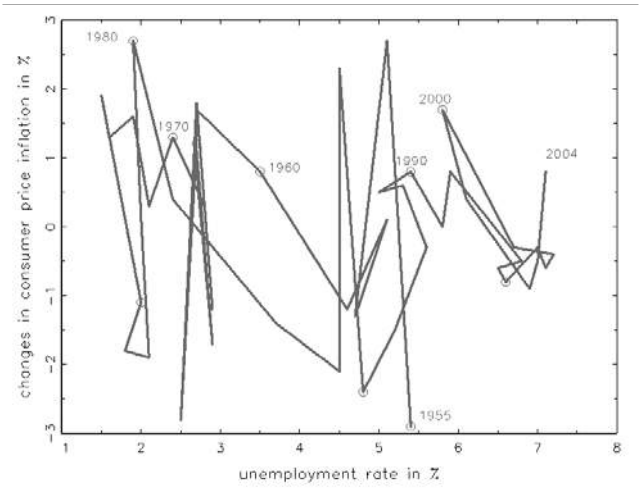

Figure 12: Accelerating variant of the PHILLIPS curve for Austria during the years 1955–2004.

A compromise. If price expectations are assumed to follow the specification $\pi_t^e = \theta\pi_{t-1}$, one obtains the modified PHILLIPS curve

$$\pi_t = \theta\pi_{t-1} + \mu + z_t - \alpha u_t \quad .$$

In this model, there is a *trade-off* between inflation and unemployment, which is however much weaker than in the classical PHILLIPS curve. BLANCHARD interprets the disappearance of the US PHILLIPS curve as an increase in θ

from nearly 0 to nearly 1. A statistical regression estimation for Austrian data yields a θ of around 0.6. A different interpretation of θ views this parameter as the share or intensity of indexed wage contracts. Such indexation plays a strong role during episodes of hyperinflation: if wages are indexed to the *current* rate of inflation, then θ can be greater 1. Others see in $\theta\pi_{t-1}$ a '*core inflation*', which does not necessarily coincide with π_t^e.

Summary: Out of the AS–curve, which plots prices against output (or the unemployment rate), PHILLIPS created the Phillips curve, which plots price inflations against u, even later followed a variant of the Phillips-curve, which plots growth rates of price inflation against u. In summary, a deviation from the natural rate u_n, or the NAIRU, can only be achieved, if prices increase *more strongly* than it was assumed by workers who negotiate their wages and thus their targeted real wage is not satisfied, such that workers are cheated upon. This is, of course, not systematically possible.

8.1 Okun's law

Apart from the Phillips curve, another empirical relationship enjoys great popularity among empirical macroeconomists, the so-called Okun's law. There is an exact one-one correspondence between natural output Y_n and the natural unemployment rate u_n because of $u_n = 1 - Y_n/L$. Therefore, it would be interesting to know how strongly deviations from natural output are reflected in deviations from the natural unemployment rate. A formula due to the economist OKUN was

$$3(u_n - u) = \frac{Y - Y_n}{Y_n} \tag{25}$$

Both sides are measured in percentages (%). If the unemployment rate is one percentage point *below* the NAIRU, then output will be 3% *above* natural

output (or potential output).

Today, this function is usually presented in a modified form:

$$u_t - u_{t-1} = -\beta(g_t - g_n) \tag{26}$$

Here, g_t denotes the actual growth rate of real output, while g_n is its 'natural' growth rate. The equation assumes that, instead of 'natural output', there is a natural growth rate g_n, which should be around 2-3%. If output grows at $g > g_n$, then the unemployment rate *falls*. If the unemployment rate in $t-1$ exactly matches the NAIRU, then it falls *below* the NAIRU in t. If output (the real GDP) grows slower than g_n, then the unemployment rate rises *above* the NAIRU. Most authors find that $\beta > 0$ is around 0.4.

Where does β come from? At low flexibility of the labor market, at high costs of *hiring and firing* (adaptation costs), it may be rational for the firms to meet an increased demand for goods with overtime work instead of new hirings of workers and, conversely, to 'hoard' workers if demand is low. Then, β will be low. If the costs of labor mobility decrease, β will rise. Many economists find that β has increased in the last 20-30 years.

Where does the natural growth rate come from? From the growth of labor productivity. If the same input of labor can produce more goods, output must increase more strongly, if it should generate an additional demand for labor.

Evidence for Austria: For Austria, the evidence on the existence of Okun's law, in the above indicated form, remains unconvincing (see Figure 13). Whereas, on average, years with good economic performance indeed have lower unemployment than years of economic slump, the autonomous developments in the labor market dominate: the decline in the work force of the Austrian industry, or rather a strong surge in labor productivity, 1980–1990, and the stabilization of unemployment in the following years in spite of

moderate economic performance. Comparative country studies confirm that Austria is an exception.

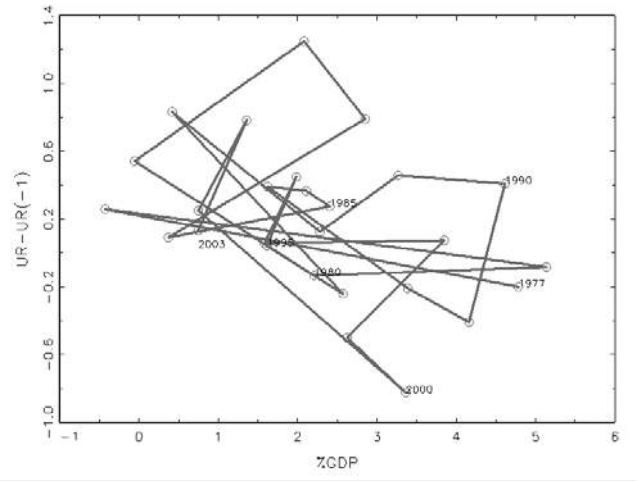

Figure 13: Okun's Law for Austrian data.

Note. OKUN's law focuses on growth rates. These are the main subject of so-called growth theory, which addresses long-run economic developments. The natural growth rate (e.g. 3%) is sometimes derived informally by considering a simple production function such as $Y = AN$. Then, if the *labor force* L, and in consequence also N, grows at 1%, the labor productivity A at 2%, then output should grow at 3%. In economic reality, structural changes, other production factors (e.g. capital) etc. play a non-negligible role.

8.2 Growth of money and inflation

BLANCHARD closes his medium-run model, which contains a Phillips curve in a debatable variant in differences

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n) \quad , \tag{27}$$

and an OKUN's law

$$u_t - u_{t-1} = -\beta(g_t - g_n) \quad , \tag{28}$$

by a third equation that relates growth rates. This equation is derived from the AD curve

$$Y = Y(\frac{M}{P}, G, T)$$

by simplification

$$Y = Y(\frac{M}{P})$$

and by using a linear functional specification

$$Y = \gamma \frac{M}{P} \quad .$$

This yields, for constant γ, the relationship among growth rates

$$g_{Y,t} = g_{M,t} - g_{P,t} = g_{M,t} - \pi_t \quad , \tag{29}$$

as growth rates obey the same rules as logarithms. Here, π is the growth of prices, i.e. inflation. The growth rate of Y is written in a clearer notation as g_Y, while it is denoted by g in OKUN's law.

From the three relationships, one sees that an equilibrium is obtained if $u_t = u_n$ and $g_t = g_n$. Then π not does not change any more, the level of inflation is determined by the expansion path of money supply. In theory, one could choose $g_M = g_t$ and thus achieve simply $\pi = 0$.

Growth rates and logarithms. If it holds that

$$Z = XY \quad ,$$

then this implies that

$$\log Z = \log X + \log Y \quad .$$

If the 3 variables depend on time, this equation can be differenced with respect to time t:

$$\begin{aligned} \frac{d\log Z}{dt} &= \frac{d\log X}{dt} + \frac{d\log Y}{dt} \\ \frac{dZ/dt}{Z} &= \frac{dX/dt}{X} + \frac{dY/dt}{Y} \end{aligned} \tag{30}$$

These would be growth rates in 'continuous time', i.e. if time passes continuously, not in jumps or intervals. For the usual discrete-time growth rates

$$g_{Z,t} = \frac{Z_t - Z_{t-1}}{Z_{t-1}} \quad , \tag{31}$$

the formula $g_Z = g_X + g_Y$ holds approximately only. In the longer run, however, the time interval from t to $t+1$ is comparatively small, so one may work with the approximation.

Usage of the dynamic model. The three-equations model can be used to describe a process of *disinflation*. Starting from an equilibrium situation with $u = u_n$ and $g = g_n$ and therefore $g_M = g_n + \pi_h$ for some π_h, political forces—obviously forces in power of the money supply and therefore rather central banks than government agencies—wish to reduce π to a lower level π_l. In order to do so, they reduce g_M. An option would be $g_M = g_n + \pi_l$, which can be adopted immediately and, in consequence, yields high unemployment and low growth for a while, until eventually the new equilibrium is attained, which is characterized by $u = u_n$, $g = g_n$, and $\pi = \pi_l$. Alternatively, one could decrease g_M gradually. BLANCHARD demonstrates that the *sacrifice ratio*, i.e. the ratio of additional unemployment beyond u_n (measured in accumulated percentage points and years) divided by the disinflation $\pi_h - \pi_l$ is independent of whether the policy is gradual or immediate. This theorem is true for most variants of these dynamic linear models, though not for all of them.

9 The open economy

Contrary to the closed economy, the open economy communicates with the rest of the world. It does so on three markets:

1. **goods market (foreign trade)**: goods and (primarily touristic) services are *exported* and *imported*. The idea that exports are good while imports however are bad, insinuates restricting the free trade across borders. **Customs** correspond to indirect taxes (goods taxes) on imported goods and increase their prices (relative to domestic production), **quotas** (rationing) limit the imported quantity of certain goods. International tendency toward abolition of all restrictions on goods trade.

2. **financial market (capital mobility)**: bonds, shares, and other domestic securities are bought by non-residents, then interest and dividends are paid to non-residents. Austrians buy, e.g., foreign shares and receive dividends from abroad. Increasing international tendency toward abolition of all restrictions on such action.

3. **labor market**: international wage differentials cause **migration** (immigration = inward migration, emigration = outward migration) and the re-allocation of productive capital to countries with a low wage level. In the EU-15 area (in theory) no restriction, worldwide strict limits on migration.

The increasing openness of economies has advantages (higher welfare by international division of labor) and disadvantages (loss of national autonomy, above all, of economic policy, 'exposure' to international crises). Most economists agree that advantages dominate by far.

9.1 Stylized facts of the open goods market

Import ratio (imports/GDP) and **export ratio** (exports/GDP) increase over time in most countries. Both ratios develop roughly in parallel movements (Reasons: tendency toward a balanced current account, increase of transit-like flows: imported goods are re-exported after minor modifications). Because only **net exports** $X - \mathrm{Im}$ contribute to GDP, import and export ratios may exceed 1 and do so in some trade-oriented small economies (Singapore).

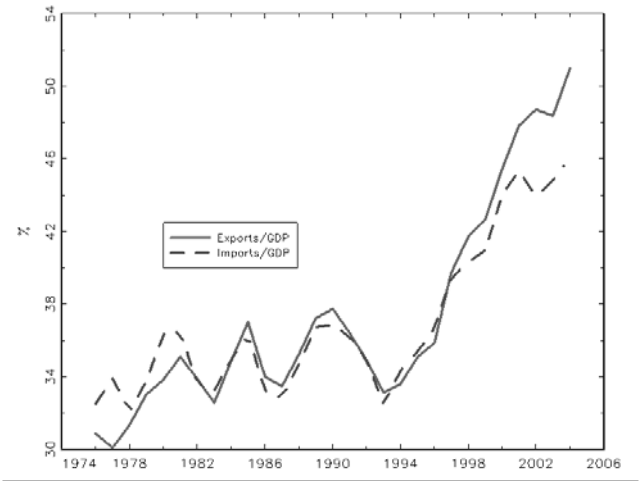

Figure 14: Import and export ratios for Austria 1976–2004.

The Austrian ratios are close to 50% now. In the longer run, exports and imports increase faster than GDP, the share of imported durable consumer goods and of imported investment goods for equipment investment is particularly high (and rising). Non-durable consumer goods are imported less intensely, goods for construction investment the least.

Main trading partner of Austria is Germany (around 42% of exports and imports), followed by Italy (more than 8%). Further important partners

are Switzerland, France, the USA, the United Kingdom, and Hungary (each 3–5%). Minor fluctuations of trade shares are mainly due to changes in the exchange rate. Major shifts often have other explanations. For example, from Figure 15, note the drastic fall of the UK share in the 1970s, which may be due to the British switch to the European Community from a common economic area with Austria in the EFTA, and the fall of the Japanese share in the 1990s, when Austria joined the European Union. By contrast, note from Figure 16 that the German trade share is subject to minor fluctuations only.

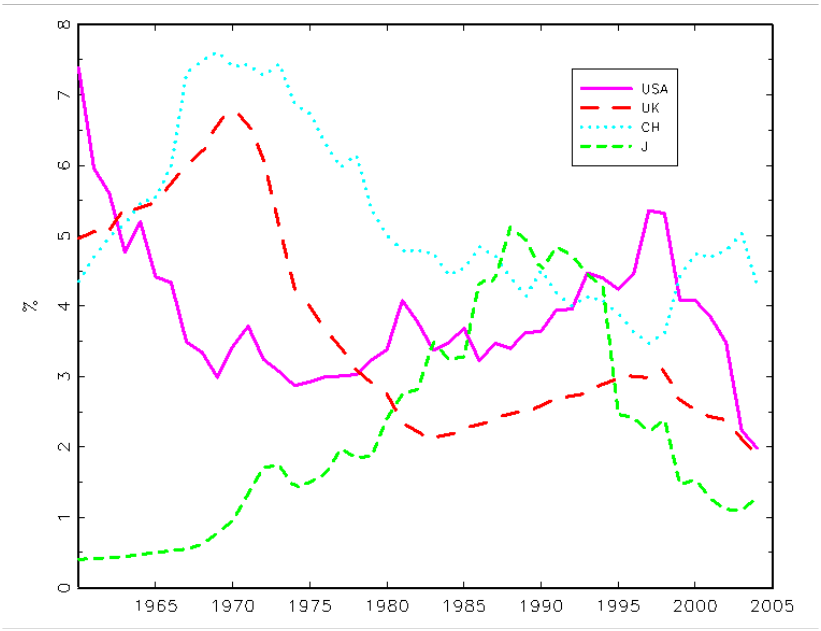

Figure 15: Shares of selected countries in Austrian imports for the time range 1960–2004. Annual data.

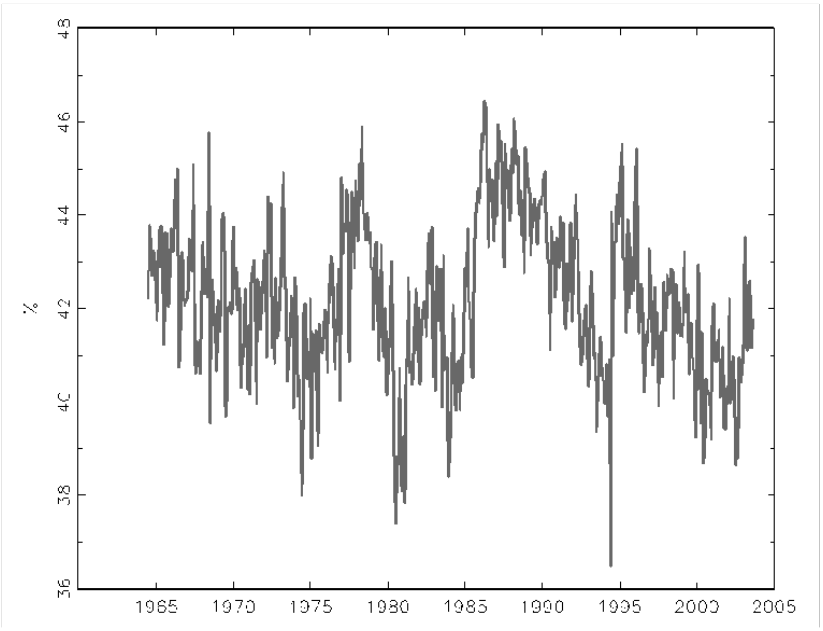

Figure 16: Share of Germany in Austrian imports 1964–2004. Monthly data.

9.2 Nominal and real exchange rates

One currency does not have an exchange rate, this word is always related to *two* currencies, e.g., euro and US dollar. From the viewpoint of the domestic economy (Austria), the **nominal exchange rate** (E) is defined as the quantity of dollars that is paid for one euro. The *larger* this value, the *more* dollars must be paid and the *higher* is the value of the euro and the *lower* is the value of the dollar. [Pure convention; this corresponds to the current official euro rates that are quoted in newspapers. You may remember figures like 12 and 18 from the schilling era, which denoted the amount of schilling that buy one dollar; this is exactly the reverse idea $1/E$. In case you use an older edition of BLANCHARD's book, note that the convention differed in editions #1 to #3.]

The **real exchange rate** (ε) tries to measure the exchange rate fluctu-

ations on the basis of a fixed good or basket of goods in 'real' terms. This is only a theoretical variable, as there are, in the real world, many different goods with diverse price movements (indexes in the domestic and in the foreign economy contain different goods and different weights). Formally, ε is defined by

$$\varepsilon = \frac{EP}{P^*} \quad , \tag{32}$$

where P denotes the domestic price level, P^* the foreign price level (formally, in foreign currency). The numerator EP and the denominator P^* represent prices that are both measured in the foreign currency (e.g., dollars or sterling in Austria). Alternatively, you may consider P and P^*/E, both priced in the domestic currency.

If the price of the domestic currency decreases in the foreign currency, i.e. if the nominal exchange rate falls, this is called a (nominal) depreciation. If the price of foreign goods in domestic currency P^*/E increases faster than the price of domestic goods, this is a **real depreciation**. Thus, at low inflation in Austria and higher inflation on the 'world market' there is a real depreciation, even if the nominal exchange rate is constant.

If the price of the domestic currency increases, i.e. the nominal exchange rate rises, this is called a (nominal) appreciation. A relatively high inflation in Austria or a price reduction on the world market and constant nominal exchange rate would imply a **real appreciation**. [There is a difference between deliberate exchange rate changes as a policy instrument, *devaluation* and *revaluation*, and normal market fluctuations, *depreciation* and *appreciation*. Note the ambiguity of *'depreciation'* as exchange rate change and consumption of fixed capital]

real effective exchange rate: a weighted average that is formed over all real exchange rates of an open economy (with all trading partners), with

all weights determined by the share in the trade volume (average of export and import), yields the real effective exchange rate. Currently, two variants are reported: one index uses consumer prices for basket deflators P^* and P, the other one uses labor costs.

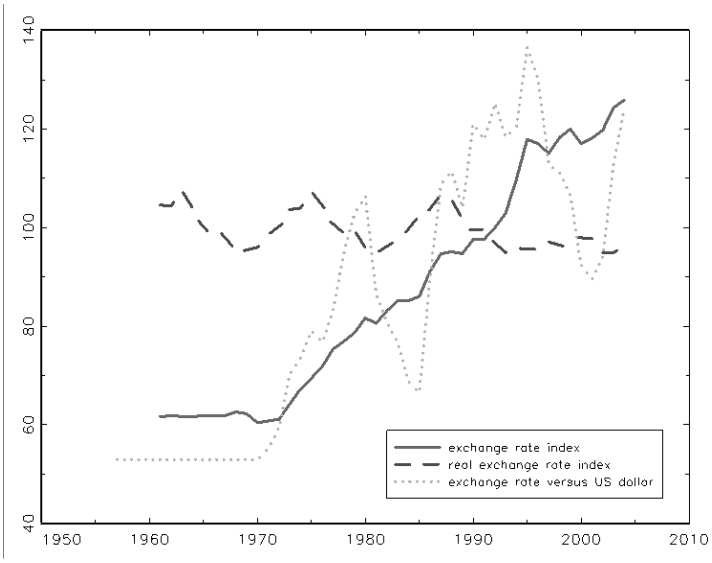

Figure 17: Nominal and real exchange rates for Austria. Exchange rate measured in US dollar per 100 euros or equivalent in Austrian schillings.

Is a real appreciation good or bad? Real appreciation implies a stronger rise of domestic prices than of world market prices or a nominal appreciation. This makes exporting more difficult and decreases the **price competitiveness**. On the other hand does an increase of *export prices* (not of domestic prices *per se*) indicate that exporters are able to sell their goods at a high price because of the high quality of their products. A real appreciation may indicate an increased **non-price competitiveness** of the domestic economy. In any case does a real appreciation exert an incentive for quality improvement and rationalization (productivity increases) in the exporting sector of the economy. [For a real depreciation, the opposite arguments hold.]

9.3 The open financial market: the interest parity

On an open financial market, residents can buy foreign securities (shares, bonds), and non-residents buy domestic securities. Such transactions make part of the capital accounts. If non-residents buy many domestic assets, a passive (negative) trade balance and also current account balance may be offset.

'**Arbitrage condition**': A domestic and a foreign bond are held at the same time, only if both promise the same return. Otherwise all bond-holders would only stock the asset that has the higher return. The expected return is composed of the expectations for the exchange rate and the interest. For a formula, one has

$$1 + i_t = E_t(1 + i_t^*)\frac{1}{E_{t+1}^e} \quad , \tag{33}$$

the so-called *uncovered interest parity* (UIP). The *left-hand* side describes the interest on a *domestic* bond. The *right-hand* side describes the behavior of a bond-holder, who first purchases foreign currency, then receives the interest on the foreign security, and finally changes back the total amount into domestic currency. The latter transaction includes a risk, as next year's exchange rate is unknown today, hence the expected exchange rate E^e is substituted. The UIP implies

$$i_t^* = i_t\frac{E_{t+1}^e}{E_t} + \frac{E_{t+1}^e - E_t}{E_t}$$

Unless the expected change in the exchange rate is extremely large, the factor E_{t+1}^e/E_t remains close to 1 and is often ignored to simplify the formula somewhat, such that the approximation of the UIP

$$i_t \doteq i_t^* - \frac{E_{t+1}^e - E_t}{E_t}$$

is often used.

Expected depreciation of the domestic currency causes a negative ratio $(E^e_{t+1} - E_t)/E_t$ and thus a relatively higher interest in the domestic economy, **expected appreciation** means a higher interest abroad. In some countries with a strong expectation of depreciation, the relation is seemingly violated, as there an even higher return must be offered to compensate for the high risk of such bonds.

9.4 The open goods market

In an open economy, the **demand for domestic goods** is given by

$$Z = C + I + G - \mathrm{Im}/\varepsilon + X \tag{34}$$

with exports X and imports Im. The correction factor $1/\varepsilon$ indicates that foreign goods in imports Im differ from domestic goods in their value. In the National Accounts, of course, Im/ε is booked as 'real imports'.

Domestic demand $C + I + G$ follows the hitherto used pattern

$$C(Y_D) + I(Y, r) + \bar{G} \tag{35}$$

The **import function** (import demand)

$$\begin{aligned} \mathrm{Im} &= \mathrm{Im}(Y, \varepsilon) \\ &\quad (+, +) \end{aligned} \tag{36}$$

lets imports depend positively on domestic demand, without decomposition into imports by particular demand categories, and positively on the real exchange rate. The latter reaction stems from the fact that, at a higher ε, foreign goods are relatively cheaper and tend to substitute domestic goods.

The **export function** (export demand)

$$\begin{aligned} X &= X(Y^*, \varepsilon) \\ &\quad (+, -) \end{aligned} \tag{37}$$

lets exports depend positively on foreign demand Y^* (demand on the world market), and negatively on the real exchange rate, as a real depreciation makes exported goods cheaper and more competitive.

Note that imports depend positively on income, while exports do not react to Y. Therefore, at low Y net exports $NX = X - \mathrm{Im}/\varepsilon$ are positive, and at high Y net exports are negative. Therefore, to every given ε there is an income Y_{TB}, at which the trade balance is exactly equalized. This Y_{TB} need not correspond to the equilibrium on the domestic goods market. For example, it seems that the US goods market is in its equilibrium at a passive trade balance, i.e. the domestic economy demands more than $Y_{TB} - NX(Y_{TB})$. Currently, the Austrian foreign trade may be balanced.

Thought experiment 1: Increase of demand.

1. Increase of G (expansionary fiscal policy) raises imports Im/ε, however not by not the same amount. Therefore, higher Y results, with multiplier effects in I and C likewise reflected in imports. Y increases, X does not change, Im/ε increases, while NX falls. Therefore, the trade balance becomes more passive. A part of the multiplier effect is satisfied by imported goods.

2. Increase of foreign demand Y^* raises exports X. Although the additional demand in NX and thus in Y is satisfied partly by imports, there remains a positive net effect. The trade balance becomes more active, income increases.

Conclusion: An increased foreign demand is good, an increased domestic demand is bad for the trade balance. [Every foreign economy is, however, also a domestic economy]

Thought experiment 2: Devaluation.

At given fixed prices in the domestic economy (P) and in the foreign economy (P^*), a nominal depreciation causes a real depreciation (ε decreases). Because of

$$NX = X - \mathrm{Im}/\varepsilon = X(Y^*, \varepsilon) - \mathrm{Im}(Y, \varepsilon)/\varepsilon,$$

the net effect of a depreciation on net exports and thus on Y is uncertain. Exports tend to increase and imports tend to decrease: these two effects tend to increase NX. However, imports become more expensive, as $1/\varepsilon$ increases, and this effect tends to decrease NX. The condition by MARSHALL-LERNER tells that the net effect is positive. Most economists agree that this condition is fulfilled for most countries.

Conclusion: a depreciation together with a restrictive fiscal policy leads to the (sometimes desired) disappearance of a trade deficit and to constant Y at reduced domestic demand. Should work in theory.

Dynamics: Because the contrary direct effect of ε in the equation for NX occurs immediately, while the effects on export demand abroad and on import demand in the home economy occur with a delay, after a depreciation one often observes at first a **fall** in net exports (imports become more expensive immediately) and then a gradual **increase**, according to MARSHALL-LERNER beyond the starting value. Some economists see the letter 'J' in this reaction, and they call this effect the **J curve**. The time range to an improvement in the trade balance appears to last up to one year.

9.5 Investment and saving in an open economy

In a closed economy, the simple identities $S_H + T - G = I$ or $S_H + S_P = I$ hold. In an open economy, it follows from the identity

$$Y = C + I + G - \text{Im}/\varepsilon + X$$

after subtraction of $C + T$ on both sides that

$$Y - C - T = S_H = I + G - T - \text{Im}/\varepsilon + X$$

or

$$S_H + S_P - NX = I \quad .$$

Investment equals the sum of 3 positions: household saving, government saving, and the negative trade balance. The third position expresses financing of investment by net imports and therefore by foreign debt.

Conclusion: Countries with a high household-saving rate and budget surplus either have a positive trade balance or invest very much. A higher budget deficit is either compensated by more household saving, less investment, or a deficit in the trade balance.

Even this identity is an *ex post*–identity only and does not describe a behavioral mechanism. For example, it is not recognizable that a depreciation or appreciation *indeed* affect the trade balance, although it seems that NX is defined by $S_H + S_P - I$. The change of ε implies a change in demand and affects both S_H and I.

9.6 The IS-LM–model in the open economy

MUNDELL-FLEMING **model**. The analysis of economic policy in an open economy on the basis of the IS-LM diagram with the cases of flexible and fixed

exchange rates is due to MUNDELL (Nobel prize) and FLEMING. Besides the usual (Y, i) diagram, one often uses (not in BLANCHARD) the representation in the (Y, E)–world.

While the LM equation of the closed economy

$$\frac{M}{P} = YL(i)$$

continues to hold in the open economy, there are important changes to the IS equation for equilibria in the goods market (for simplification, written in the nominal interest rate i, i.e. for $\pi^e = 0$)

$$Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, \varepsilon)$$

and there is the interest parity (in the exact form)

$$E_t = \frac{1 + i_t}{1 + i_t^*} E_{t+1}^e$$

At a given expected exchange rate $E_{t+1}^e = \bar{E}^e$, one may express E as

$$E = \frac{1 + i_t}{1 + i_t^*} \bar{E}^e. \tag{38}$$

Assuming additionally that, at least in the short run, P and P^* do not move, one may substitute this expression for the (nominal) exchange rate instead of the real exchange rate in the IS equation:

$$Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, \frac{1 + i}{1 + i^*} \bar{E}^e)$$

and one obtains a negatively sloped IS curve in the (Y, i) diagram. Because a higher interest rate negatively affects both investment and net exports (i is in the numerator of the last expression, E and therefore ε increases and thus NX falls by 'appreciation'), one may think that the curve would be 'flatter' than in a closed economy and monetary policy would have stronger

effects. The intersection of the LM and IS curve does not only determine an equilibrium pair (Y, i), but also an equilibrium exchange rate.

fiscal policy in the open economy. The change in public demand causes a shift of the IS curve at a rigid LM curve. For example, expansionary fiscal policy. Both Y and i rise. The higher interest rate causes an appreciation because of (38), i.e. E increases. In summary, private consumption increases (depends directly on Y), while the behavior of investment is uncertain (higher Y, but also higher i), and net exports fall (MARSHALL-LERNER). In other words, the trade balance deteriorates.

Monetary policy in the open economy. The change in the money supply causes a shift of the LM curve at rigid IS curve. For example, expansionary monetary policy. Y rises, but i falls. The lower interest rate causes a depreciation, E falls. Private consumption, investment, and net exports increase. This apparently ideal case includes, of course, the risk of inflation.

Fixed exchange rate. For diverse reasons, e.g., to eliminate exchange rate risk, it may seem attractive to keep the nominal exchange rate E fixed. The UIP determines the interest rate i uniquely, as i^* and E^e are exogenous. Therefore, at a fixed exchange rate there is no independent monetary policy any more, this policy instrument is no more available. Because E and E^e must coincide in the longer run, one sees from the UIP that $i = i^*$ must hold, i.e. there is only one 'international' interest rate. The advantages of a fixed exchange rate, such as easing of border-crossing trade with its welfare-increasing effect, must be gauged against the disadvantage of abandoning monetary policy as an instrument of economic policy.

Narrow-sense model cases of MUNDELL-FLEMING. While in the BLANCHARD variant with flexible exchange rate, the expected exchange rate E^e is exogenous and fixed, which entails certain logical problems, MUNDELL-

FLEMING assume in the simplest case $E^e = E_t$, which implies $i = i^*$, also for a flexible exchange rate. Then, one may draw IS and LM curves in the (Y, E)–world.

1. With **flexible exchange rates,** the LM curve becomes *vertical*, as $i = i^*$ and the exogenous money supply determines Y uniquely. The IS curve is negatively sloped, because of the influence of net exports and the MARSHALL-LERNER–condition. Fiscal policy is ineffective and only affects the exchange rate. Monetary policy changes output directly.

2. With **fixed exchange rates,** the LM curve disappears, as the money supply is set *endogenously*, such that the exchange rate is maintained The IS curve continues to be negatively sloped and intersects a *horizontal* $E = \bar{E}$–line. Fiscal policy changes output directly, while monetary policy is no more possible.