Modern International Macroeconomics

Prof. Dr. Paul J.J. Welfens
www.eiiw.eu

Wuppertal University (Schumpeter School) and Sciences Po,
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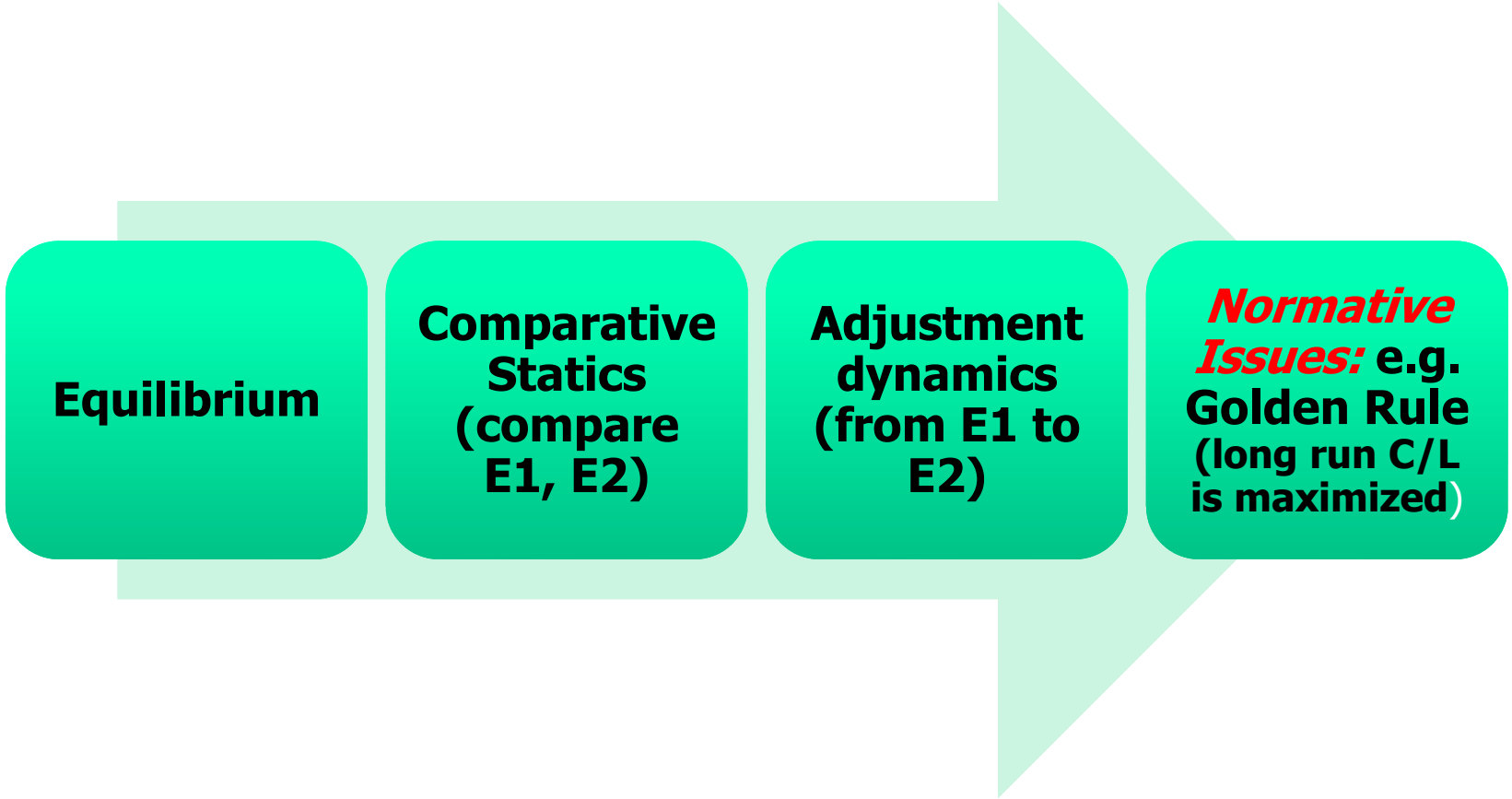
Macroeconomics as an Analytical Tool

- Standard international macroeconomics is a refined body of research (and teaching; Obstfeld/Rogoff, Foundations of International Macroeconomics):
  - Intertemporal Trade and the Current Account Balance
  - Dynamics of Small Open Economies, **Economic Interdepency**
  - The Life Cycle, Tax Policy and the Current Account
  - The Real Exchange Rate and the Terms of Trade
  - Uncertainty and International Financial Markets
  - Imperfecctions in International Capital Markets
  - Global Linkages and Economic Growth
  - Money and Exchange Rates under Flexible Prices
  - Nominal Price Rigidities: Empirical Facts & Basic Open-Economy Models
  - Sticky-Price Models of Output, the Exchange Rate and the Current Account

Required Reading

- 1) Technical paper Frequently Asked Questions on the Conference Board's Alternative China GDP series (TCB, 2015, 12 pages)
- 2) Facundo, Atkinson, Piketty, Saez (2013), Journal of Economic Perspectives: The Top 1 Percent in International and Historical Perspective, Vol. 27, 3-20
- **3) EIIW paper No. 212 (Jungmittag/Welfens, 2016), www.eiiw.eu**
- 4) EIIW paper No. 213 (Welfens)
- **5) contribution in Journal of Economic Literature on New Keynesian Economics…**

Explaining Equilibrium and Dynamics of Adjustment



What is required in modern macroeconomics

- i) explaining **normal** output changes, current account dynamics; unemployment, inflation, oil price (?deflation)
- ii) explaining international economic crisis (start, diffusion), policy options and policy actually implemented
- iii) macroeconomic dynamics in a period of economic globalization: trade, foreign direct investment, migration, internet, regional integration

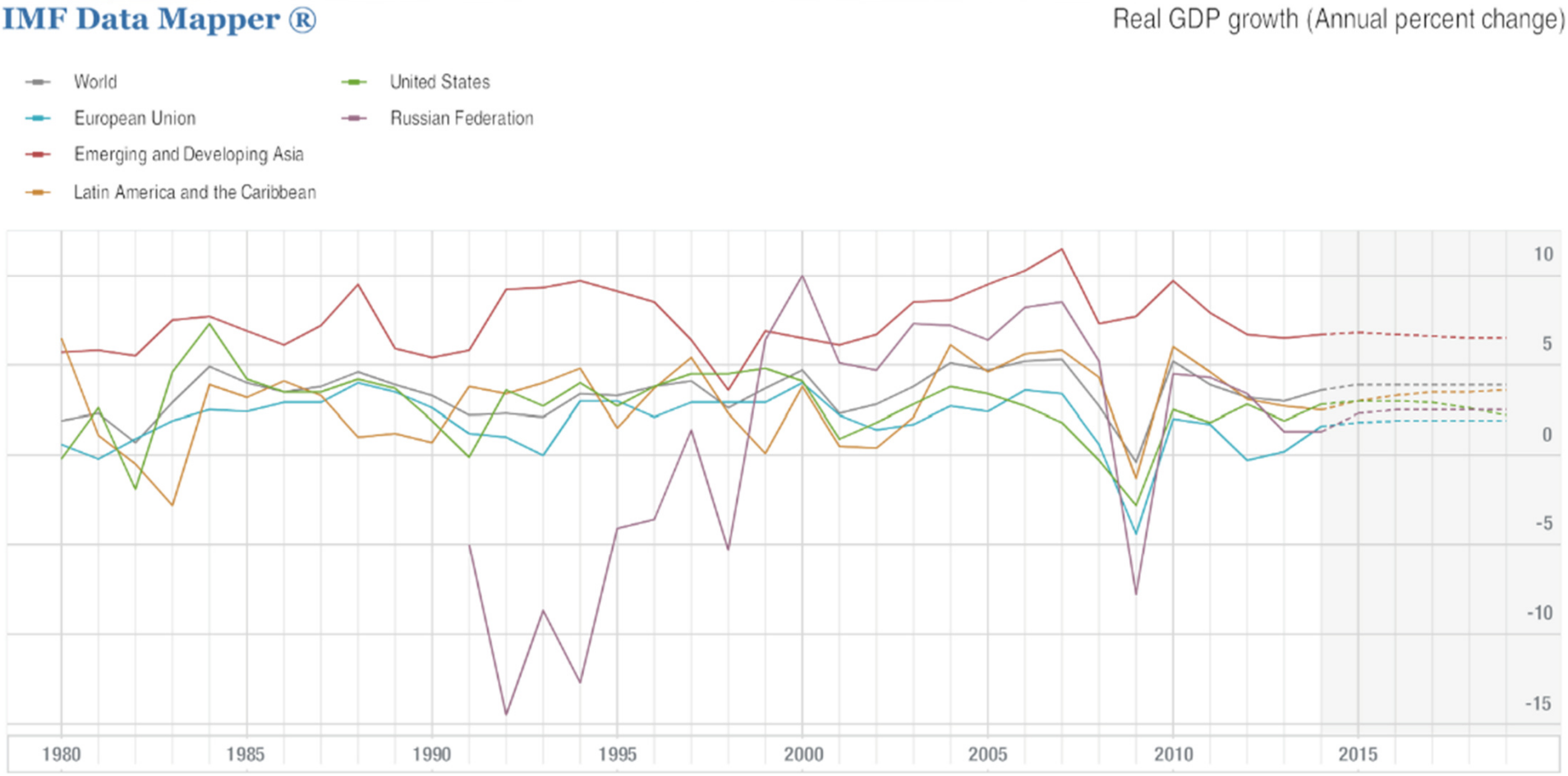
Macroeconomics

- Explaining changes in the
  - **real economy** – output (GDP), real gross national product (GNP; real income), unemployment rate (u), consumption (C), investment (I), government expenditure (G, exogenous?), exports X, imports J; capital intensity k:=K/L; y:=Y/L; A knowledge
  - and the **monetary economy**: exchange rate (e), price level (P; dlnP/dt inflation rate), stock market price (P‘), nominal interest rate (i), real interest rate (r), price of non-renewable resources (P“); q*:= eP*/P

Macroeconomics

- Understanding how **economic systems** and **macro markets** work (and microeconomic foundation to that extent necessary)
- **Capital accumulation** dynamics and other real developments
- **Financial market dynamics**
- **Policy Issues**
  - Monetary policy (in country 1 and 2...)
  - Fiscal policy (in country 1 and 2); other policy

Fig. 1. Output Growth



World Output: China, US, EU

- Real GDP (PPP purchasing power parity)
  - 2015 China for the first time>US and EU
  - China 1.4 mill., USA 330 mill., EU 510 mill. people (of 7 bill. global total); triade **interdependency:** IMF (2014) Chinese reforms=+100$ income gain for everybody outside China
  - The Conference Board (US): **China 16% of world GDP,** only in **2025** higher (18% of world GDP) than US GDP; growth rates and GDP smaller than official figures (statistical problems); 5 year growth trend is 4,5%, China 2015: 3,8% (official 6.9%).

$Y = Y(K,L,A)$; $Y = AK^{\beta}L^{1-\beta}$ Hicks neutral

- **Growth decomposition (ß income share of capital)**
  - $g_Y = \beta g_K + (1-\beta) g_L + a$ where a is growth rate of knowledge A or total factor productivity (TFP) growth; K is capital, L is labor, g is growth rate; unclear how big TFP growth is in China
  - **Innovation and ICT expansion, FDI inflowsΣ** (ICT information & communication technology) brings high TFP growth – 1 to 2 % is high; Conference Board: 2015 it was zero in China(?)
  - Production function (Harrod-neutral progress) $Y = K^{\beta}(AL)^{1-\beta}$

Long Run Output Growth

- Growth rates in **rapid catching-up countries** can be 7-9% (Japan, Korea, China:different decades after 1960)
  - Capital accumulation requires savings
  - High savings if there is no social security and per capita income y:=Y/L exceeds critical value y‘; confidence in banks and property rights necessary, role of tax incentives;
  - L from demography and immigration, human capital formation (quality of L)
  - Innovation from research & development (R&D) expenditures, FDI inward stock/GDP, other;

knowledge production function says A‘(patent applications)

- Concept from Griliches; Machlup 1979; various extensions, including Jungmittag/Welfens (EIIW paper 212, 2016; for 20 EU countries empirical analysis – refering to TTIP)
  - Trade is expected to have positive impact on knowledge – a) via intermediate inputs imported (recall that import volume J=jY; X= xY*); b) Melitz (2013) arguments explaining relevance of exports for innovation dynamics/improving technology in the context of heterogenous firms: ***open up and..***; most innovative firms survive and expand
  - Number of researchers
  - FDI inward stock/GDP

Alternatively: stock of knowledge (stock of patents) is modelled through knowledge production function, e.g...

- (1) $A=(R/L)^{ß'}(j'J/L)^{ß''}k=R'^{ß'}(j''y)^{ß''}k$; $j'':=j'j$; $R':=R/L$; $k:=K/L$ (capital intensity)
  - Production function (2) $Y=K^{ß}(1-R')L^{1-ß}$; R' is small – is the share of researchers R in labor force L; $0<ß'<1$, $0<ß''<1$
  - Growth rate of knowledge is $dlnA/dt = ßdln(R/L)/dt + ß''dlny/dt + dlnk/dt$
- Hence $AL/K = f(R/L; y)$ where AL is labor in efficiency units; or $A = f(R/L; y)k$
  - Knowledge A function can be plugged into macro production function

Combining knowledge function and macro production function:

- We can plug $A=j^{\alpha}(R/L)^{\beta}y^{\alpha}k$ directly into macro production function $Y=K^{\beta}(A(1-(R/L))L)^{1-\beta}$; see Welfens (2016; EIIW paper No. 211); we will use $\ln(1+x)\approx x$ for small x:
  - $\ln y = \beta\ln k - (1-\beta)(R/L) + (1-\beta)(\beta^{\alpha}\ln(R/L) + \beta^{\alpha}(\ln y+\ln j^{\alpha})+\ln k)$; now **as if economies of scale in k**
  - $\ln y=(1+(1-\beta)\beta^{\alpha})\ln k+((1-\beta)\beta^{\alpha}(1+(1-\beta)\beta^{\alpha}))\ln(R/L)$

$-(1-\beta)(1+(1-\beta)\beta^{\alpha}(R/L) +\beta^{\alpha}(1-\beta)/(1- (1-\beta)\beta^{\alpha})\ln j^{\alpha}$; *where $(1-\beta)\beta^{\alpha}$ is close to zero by assumption*

  - We can see that there is critical R/L which makes

Knowledge production function plugged into macro production function...

- Thus we get a better **understanding of role of researchers** and other factors affecting long run trend output growth (determined by the growth rate of knowledge) and the level of the growth path, respectively
- **Total factor productivity growth in the US** strongly affects EU countries (via trade, FDI inflow into EU; EU FDI to US; recently internet)
- One might also consider function dA‘/dt = F(....); calculate steady state A/k (where k:= K/L) so that (AL)/K can be inserted in the production function; possibly looking also at savings rate.

Inward FDI

- **FDI presence (inward) brings international technology transfer**; also stimulates competition and thus innovation dynamics; in banking this might undermine stability if decent standards of banking are destroyed (? some US banks in?)
- **Outward FDI** (e.g. Germany/EU in the US, US in EU; China in EU or US) reflects asset-seeking FDI; e.g. German or Swiss pharmaceuticals investing in the US

Trend Output Growth and Cyclical Variation

- Y/Y^{pot} falling, then unemployment rate will rise (and in China the number of migrant workers who go back to the country side where family is living)
- A recession will normaly last only about 1 year
  - Unnormal recession in the 1930s US (4 years=-27% output, mass unemployment), UK, France, Germany (3 years); Greece 2009-15

Fig. 2. Unemployment Rate

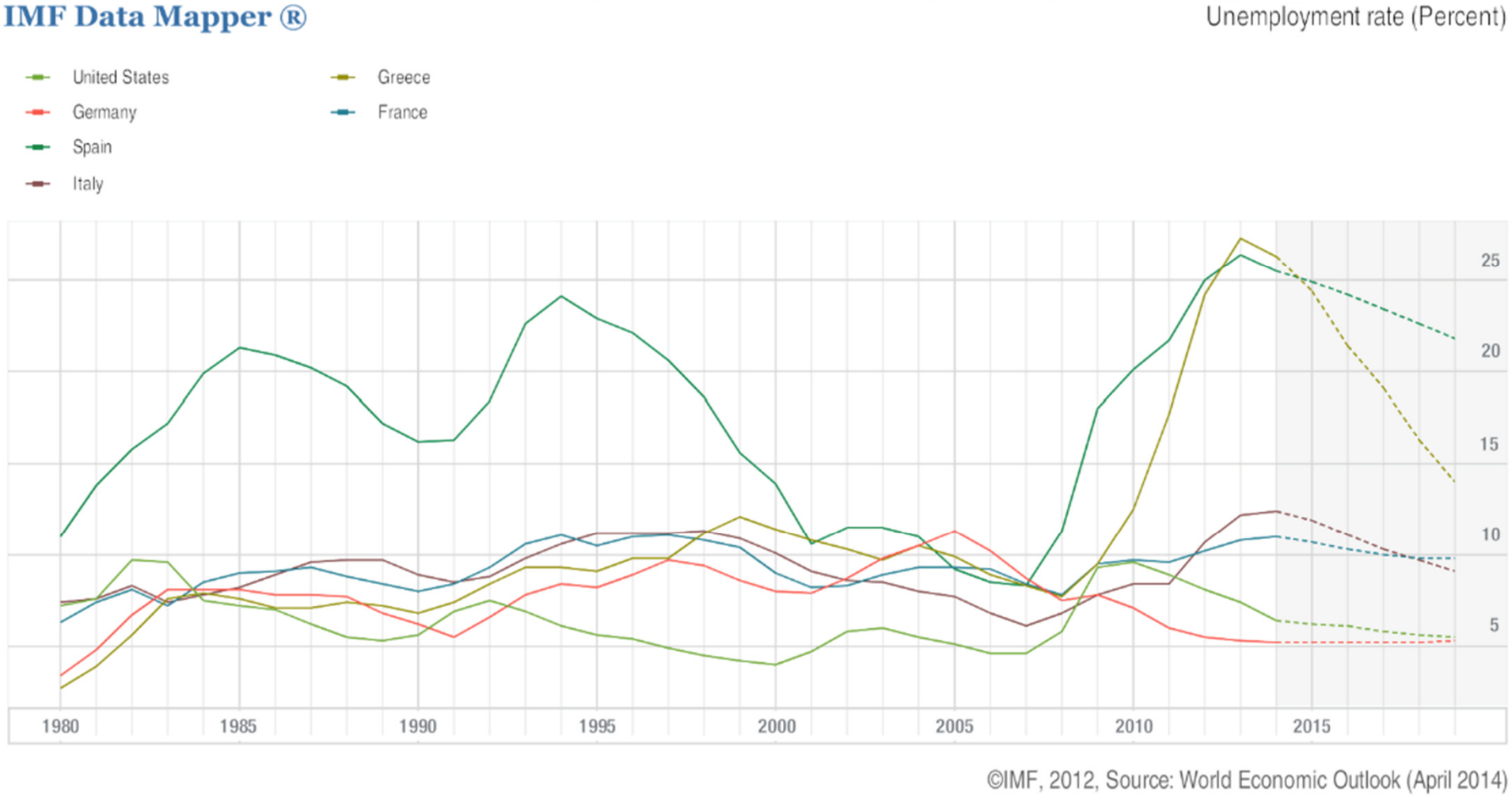


Fig. 3. Inflation Rate

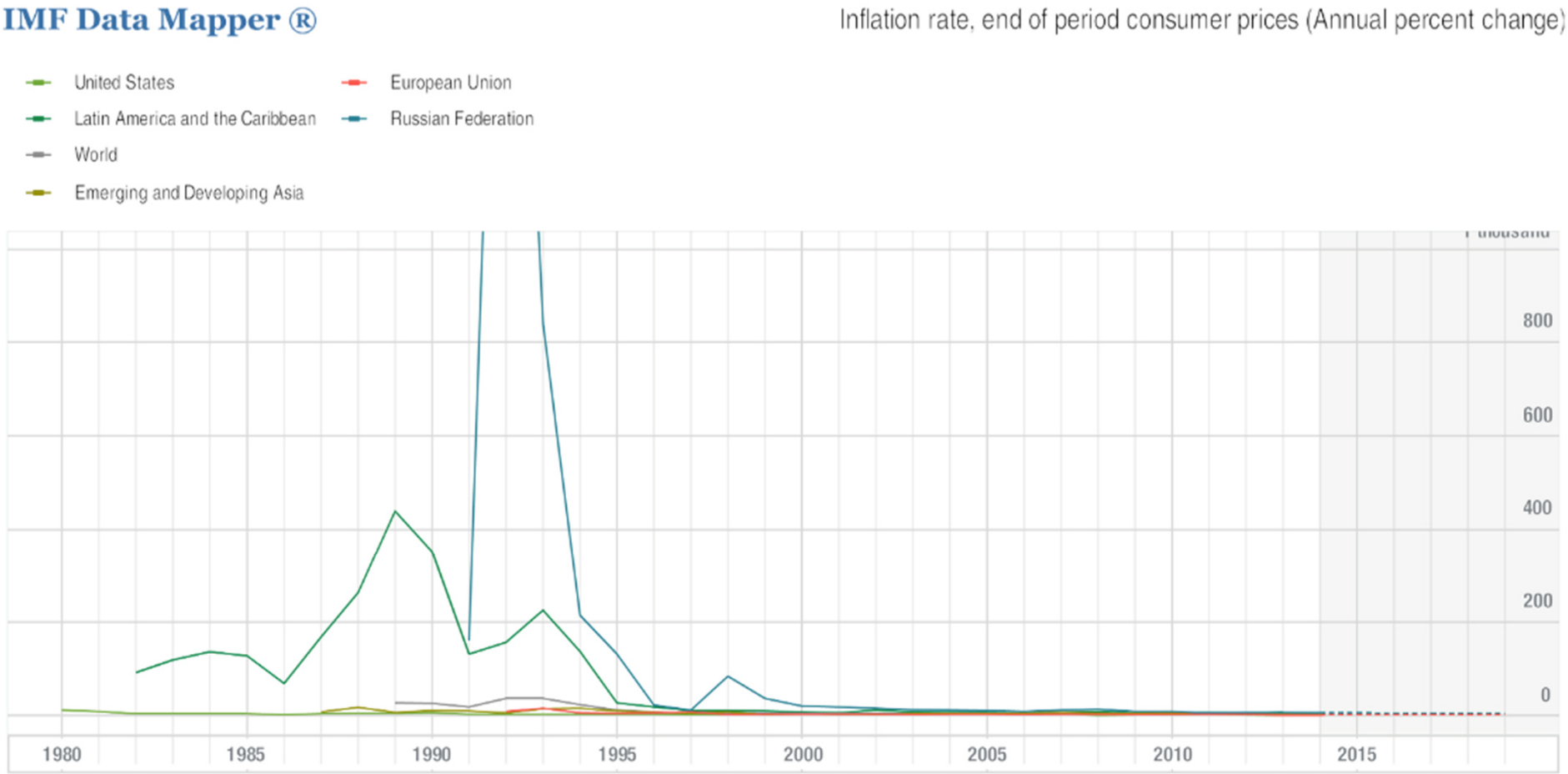
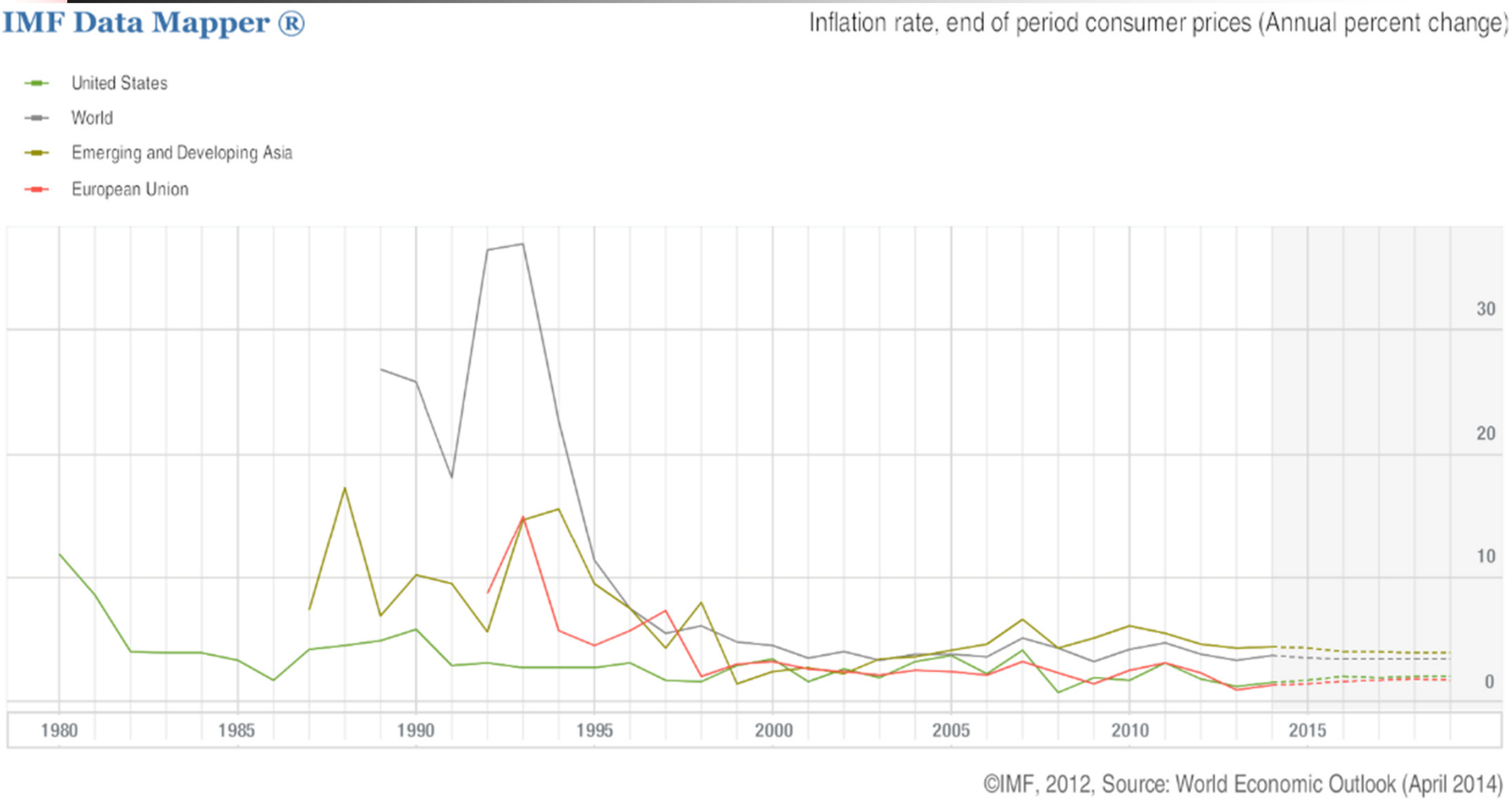


Fig. 4. Inflation Rate



Deflation also as a problem

- **Deflation** means a negative inflation rate; that is a fall of output price index
- Deflation problems in the 1930s; generally real debt of firms and governments rises: B/P!; will reduce investment and output growth; fall of P raises real wage rate(unemployment!)
- Deflation possibly related to deflation expectation and negaive output gap (recession) – and appreciation of the currency!
- Small inflation rate in Eurozone in late 2014/2015-16; ECB has adopted Quantitative Easing – expansionary open market policy (ECB will buy government bonds and other assets for about 1100 bill. € in 2015/2016)

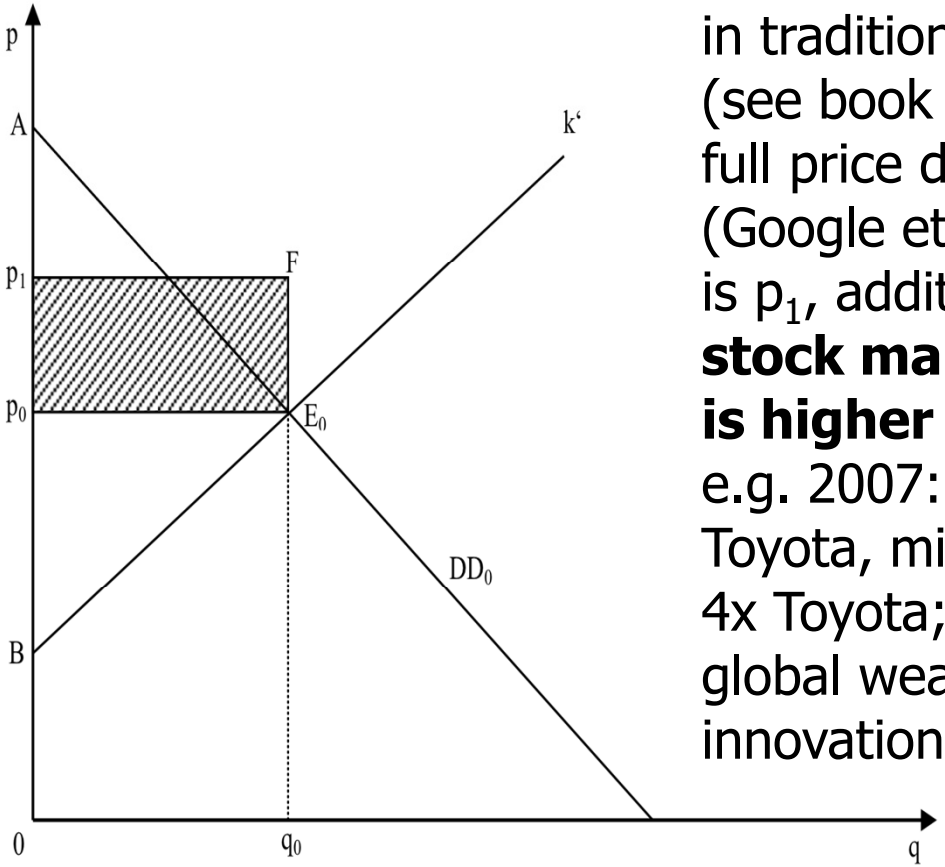
New Issues in Macroeconomics

- Declining income inequality across countries
- **Rising income inequality within** OECD countries (Facundo/Atkinson/Piketty/Saez, 2013)
- Income share of top 1% of income pyramid has almost **doubled between** 1980 and 2000 in the US, UK and some other countries (20%); due to reduced top marginal income tax rates? (and opportunities of Panama tax haven shells)

Question about reason for rising top 1% income (inequality)?

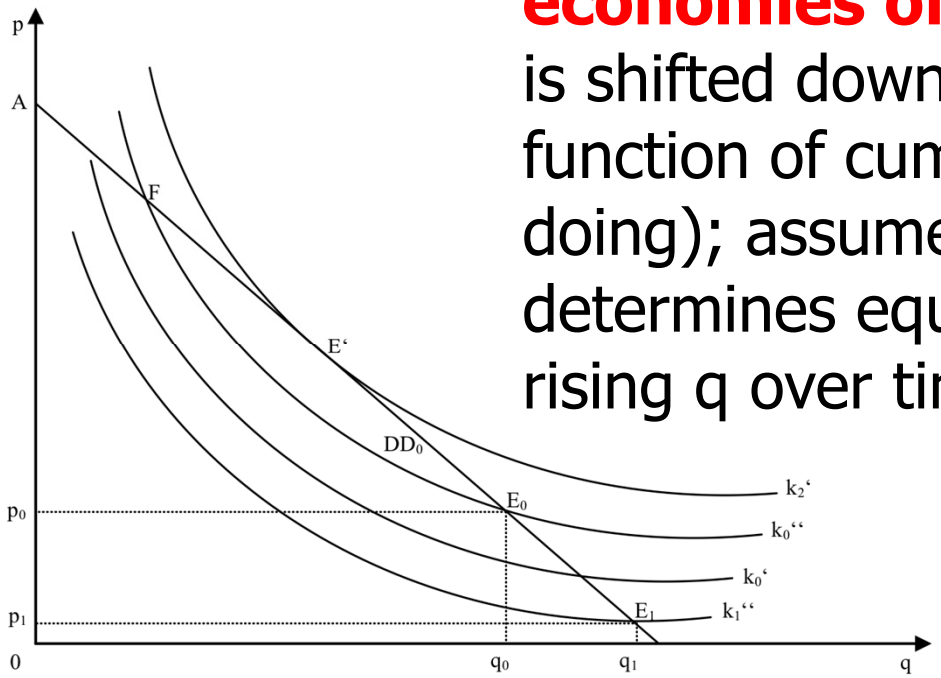
- OECD:inequality undermines economic growth
  - Not fully clear is the logic of this statement 2015
- Income inequality rising: **Why?**
  - Top tax rade reduced (Piketty), bargaining power+
  - Role of ICT expansion = more price differentiation and higher share of profits (capital income); Welfens, 2016 (see ranking of inequality countries and ICT-capital intensity, internet density); valuation of digital companies higher than average. High growth and higher inequality in tandem? US, China?

Perfect Price Discrimination (p_1 is ½ of distance Ap_0)



Under full competition the equilibrium price is p_0 in traditional economy; in the **Digital Economy** (see book Welfens Interneteconomics.net) with full price differentiation based on algorithm (Google etc.) the **average market price** is p_1, additional profit is $p_1FE_0p_0$ so that **stock market price of average firm is higher than in traditional economy**; e.g. 2007: Microsoft market capitalization =2x Toyota, mid-2015: Apple =3x Toyota; ?Alphabet= 4x Toyota; this also implies a concentration of global wealth in the US as the global ICT innovation leader

ICT Expansion and Deflation Pressure: Economies of scale (static and ***dynamic***) in ICT whose role is rising; Welfens 2016b



Declining marginal cost curve (k‘)= ***static economies of scale***; ***dynamic*** means that k'_0 is shifted downwards over time (k‘ is a negative function of cumulated output= learning by doing); assume that average cost kurve k‘‘ determines equilibrium: sequence FE_0E_1 and rising q over time,falling market price over time

Three Types of Variables

- Endogenous (explained by model)
- Exogenous (e.g. fiscal policy: rise or fall of G)
- Pre-determined: K_{t-1} (t is time index)
- Sometimes deviation from equilibrium value x# is considered: say x – x# where x# is equilibrium value (New Keynesian Models; DSGE model); Y – Y# is dubbed the output gap: crucial; e.g. hypothesis: $\pi_t = \pi_{t-1} + h(Y-Y\#)$

Open Economy (2 countries, n countries)

- **Trade, capital flows, international migration**
- **Comparative analysis** (Comparative Systems)
- **Systemic competition:** partly related to international capital flows – particularly Foreign Direct Investment (FDI) – and migration
- *1 country, 2 countries (big), regional integration of several small and big countries, regional integration of many small countries; links between regional integration clubs; cooperation via Internat. Organizations*

Key Questions in Open Economy

- **Allocation of resources:** free competition, free trade, free capital flows, internalization of negative external effects (trans-border pollution) and of positive external effects (e.g. innovation)
  - **More or less market power** in bigger markets
  - With better exploitation of economies of scale
- **Economic stability** (financial market problems, government problems)
- **Income inequality** (globalization effects…)

Foreign Exchange Market

- In open economy we have foreign exchange market
  - A) **under fixed exchange rate regime** (with respect to $ until 1971/73; gold convertibility of $ ended under president Nixon in 1971: 2 country-model has only one exchange rate; US big country, Germany is small country: US determines tradables price level P^T (and P* is given from perspective of small open economy); Germany's central bank cannot control domestic money supply and the inflation rate, respectively – determined in the US (Mundell/H.G. Johnson: Monetary Approach to the CA bal.)
  - B) **under flexible exchange rate:** central bank can control domestic money supply M

Fixed Exchange Rate Regime (until 1972: DM German currency)

- **Mundell/Johnson: Monetary approach to the balance of payments;** tradable goods (T), non-tradables (N)
- Free trade and full international arbitrage
  - $P^T = eP^{T*}$ (e is the nominal exchange rate DM/$)
  - Price level $P=(P^N)^v(eP^{T*})^{1-v}$; $0<v<1$
  - Money market equilibrium condition is given by $M/P = h\text{“}Y_0$; parameter $h\text{“}>0$, Y is given in short term; restatement $M = Ph\text{“}Y$.
  - What happens if P^{T*} is rising (in the US)?

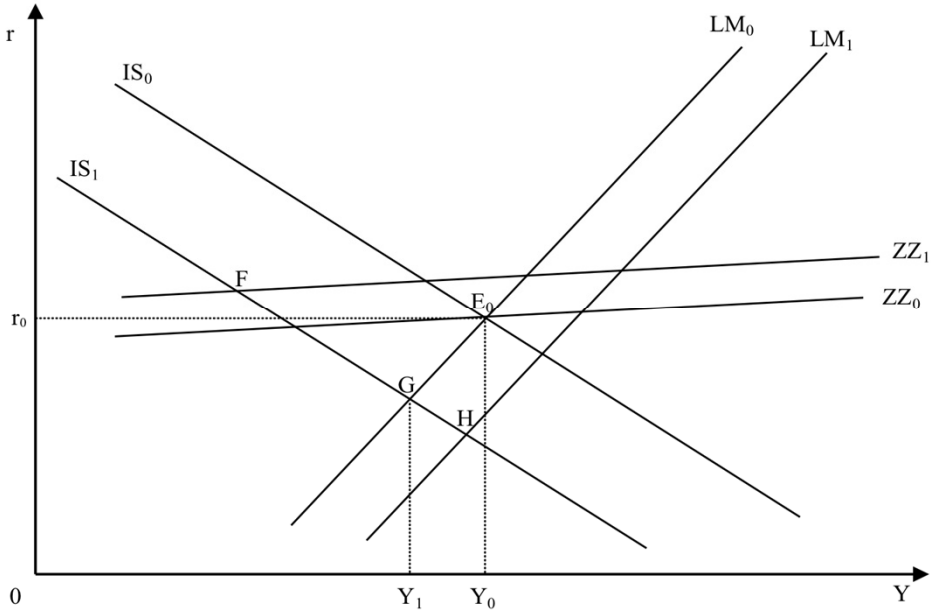
Adjustment Mechanism (Fixed Exchange Rate System)

- Rise of P^{T*} translates into rise of P^{T} and P, respectively (we continue with small open economy perspective...);
  - hence nominal **excess demand in the money market**
  - Firms raise exports = rightward shift of supply schedule in the foreign exchange market = excess supply in the market: Central bank has to intervene = rise of foreign reserves plus expansion of the stock of money (dM>0); hence ex post increase of M that is compatible with rise of P
  - CONCLUSION: foreign inflationary monetary policy (in the US/the anchor country) is transmitting inflation to other countries through induced intervention in FOREX market.

Monetary Policy Is Inefficient Under Fixed Exchange Rate Regime(Mundell Fleming Model)

- **Expansionary monetary policy (rise of M)** in small open economy (in Europe, Asia, Latin America, Africa) – under fixed exchange rate regime – and perfect capital mobility
  - Will only temporarily reduce the interest rate
  - Will cause high net capital outflows increasing the demand for $: Hence excess demand in FOREX market, central bank has to sell reserves ($) so that M is reduced **(no rise of M!)**

IS-LM-ZZ Model: Fall of Foreign Price Level (P*) if X=xY*q* - x"D"*/P* (D" is debt)

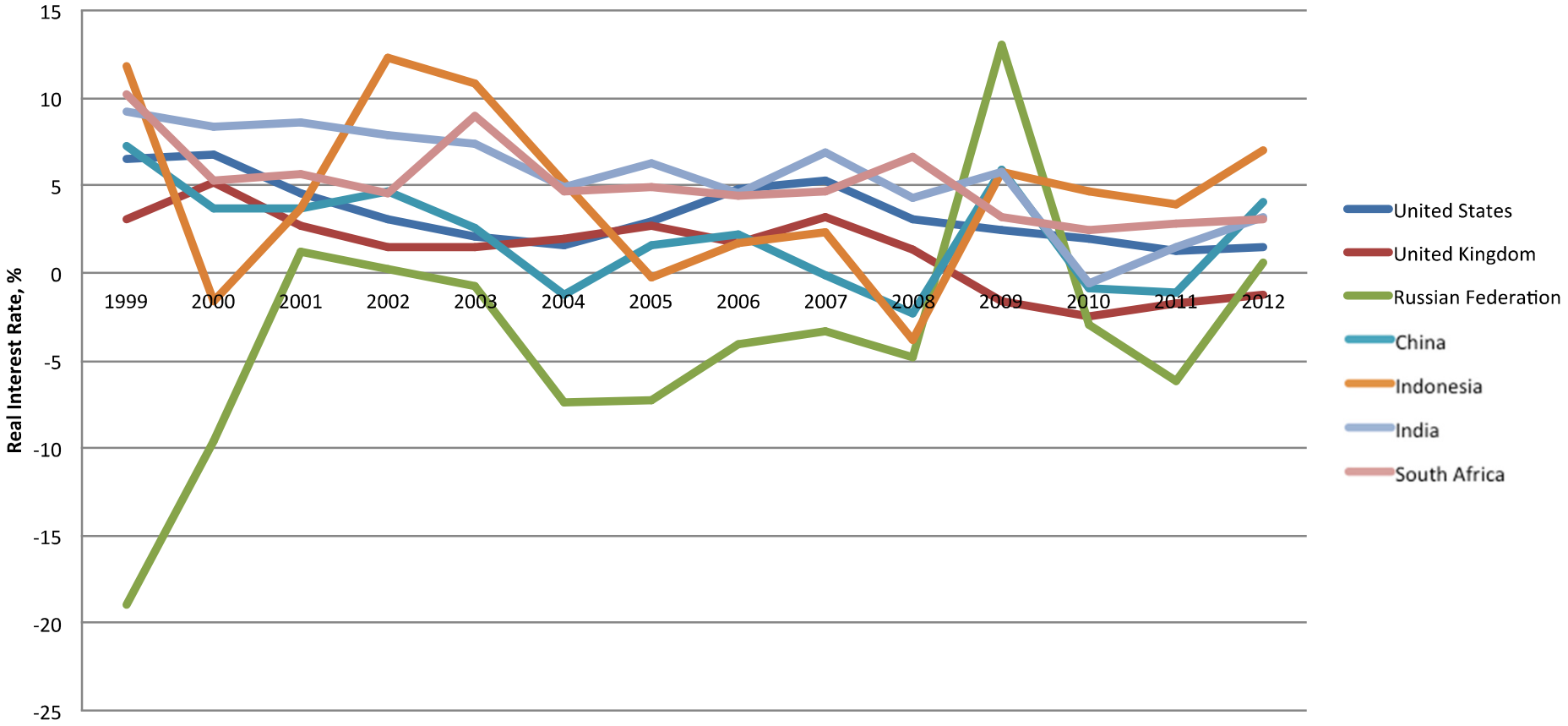


Fixed exchange rate:
P* falls, hence exports will fall, hence IS_0 to IS_1;
P also falls as P* is from big country (US); right-ward shift of LM_0 to LM_1;
ZZ_0 to ZZ_1 excess demand for foreign exchange in H;
central bank sells reserves = -dM, thus LM_1 shifts back into position LM_0 (or to F?);
flexible exchange rates better

Equilibrium Conditions (modified); assume $Y=K^{\beta}L1-\beta$ so that marginal product of capital is $\beta Y/K$; $q^*:=eP^*/P$, τ is income tax rate; $V'>0$

- (1) $Y = c(1-\tau)Y + G + b(\beta Y/K - r) + xY^* + x'q^* - q^*jY - j'q^*$ equilibrium goods market
- (2) $M/P = hY - h'r$ money market equilibrium
- (3) $V'(r-r^*) + v''q^* = q^*jY + j'q^* - xY^* - x'q^*$
  - $V'(r-r^*)$ net portfolio capital inflows; $v''q^*$ is FDI inflows
  - Equation ZZ (equlibrium line foreign exchange market) $r = r^* + ((j' - x' - v'')/V')q^* - (x/V')Y^* + (q^*j/V')Y$; note that real appreciation (q^* falls) implies that absolute term on RHS rises while slope gets smaller

Fig. 5. Real Interest Rate (%)



Source: World Bank, World Development Indicators

Tab. 1. Current Account Balance (Percent of GDP)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
France	1,5	1,8	1,2	0,7	0,5	-0,5	-0,6	-1	-1,7	-1,3	-1,3	-1,8	-2,2	-1,6
Germany	-1,7	0	2	1,9	4,7	5,1	6,3	7,4	6,2	5,9	6,4	6,8	7,4	7,5
Greece	-7,8	-7,2	-6,5	-6,5	-5,8	-7,6	-11,4	-14,6	-14,9	-11,2	-10,1	-9,9	-2,4	0,7
Ireland	-0,4	-0,6	-1	0	-0,6	-3,5	-3,6	-5,3	-5,6	-2,3	1,1	1,2	4,4	6,6
Italy	-0,2	0,3	-0,4	-0,8	-0,3	-0,9	-1,5	-1,3	-2,9	-2	-3,5	-3,1	-0,4	0,8
Portugal	-10,3	-10,3	-8,2	-6,4	-8,3	-10,3	-10,7	-10,1	-12,6	-10,9	-10,6	-7	-2	0,5
Spain	-4	-3,9	-3,3	-3,5	-5,2	-7,4	-9	-10	-9,6	-4,8	-4,5	-3,8	-1,1	0,7
United Kingdom	-2,9	-2,3	-2,1	-1,7	-2	-1,8	-2,8	-2,2	-0,9	-1,4	-2,7	-1,5	-3,7	-3,3
United States	-4	-3,7	-4,2	-4,5	-5,1	-5,6	-5,8	-4,9	-4,6	-2,6	-3	-2,9	-2,7	-2,3

Source: IMF, World Economic Outlook

Current account deficit implies rising foreign indebtedness (USA can finance 1% deficit from international seigniorage gain: foreign central banks holding $ reserves, obtaining low yield (1%) while global rate of return on capital is ca. 3-4%; international reserves rising over time ($, €, Yen, Yuan? key currencies)

Real External Debt Burden (B** real foreign indebtedness)

- Trade balance is X‘ (data: Obstfeld/Rogoff 96 p.69):
  - –(X‘ –r*B**)= dB**/dt; note that supply of foreign exchange=X‘, demand for FOREX is r*B**; divide equation by Y; denote B**/Y as b**, g_Y output growth
  - -(X‘/Y – rB**/Y) = db**/dt + g_Yb** = (dB*/dt)/Y
  - -(X‘/Y –(r-g_Y))b** = 0; assuming db**/dt is zero
  - X‘/Y = (r-g_Y))b**; trade balance surplus/GDP>0; we assume r>g_Y. Real external debt burdens (% of GDP), 1970-91: Argentina 1970: 0.5, 1983 2.9%, 1991: 3,9%; Nigeria 1991: 4,8%, Hungary: 1991: 3,8%

Tab. 2. General Government Consolidated Gross Debt: Excessive Deficit Procedure (based on ESA 1995), (Percent of GDP)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Germany	60,2	59,1	60,7	64,4	66,2	68,6	68,0	65,2	66,8	74,5	82,5	80,0	81,0	79,6
Ireland	37,0	34,5	31,8	31,0	29,4	27,2	24,6	24,9	44,2	64,4	91,2	104,1	117,4	122,3
Greece	103,4	103,7	101,7	97,4	98,9	110,0	107,8	107,3	112,9	129,7	148,3	170,3	156,9	177,3
Spain	59,4	55,6	52,6	48,8	46,3	43,2	39,7	36,3	40,2	54,0	61,7	70,5	86,0	94,3
France	57,5	57,1	59,1	63,3	65,2	66,8	64,1	64,2	68,2	79,2	82,4	85,8	90,2	93,9
Italy	108,6	108,3	105,4	104,1	103,7	105,7	106,3	103,3	106,1	116,4	119,3	120,7	127,0	132,7
Cyprus	59,6	61,2	65,1	69,7	70,9	69,4	64,7	58,8	48,9	58,5	61,3	71,1	85,8	112,0
Portugal	50,7	53,8	56,8	59,4	61,9	67,7	69,4	68,4	71,7	83,7	94,0	108,2	124,1	129,4
United Kingdom	40,5	37,3	37,1	38,7	40,3	41,7	42,7	43,7	51,9	67,1	78,4	84,3	88,6	91,4
United States	53,0	53,0	55,4	58,5	65,4	64,9	63,8	64,4	73,3	86,3	95,2	99,5	102,9	103,8

Source: AMECO Database

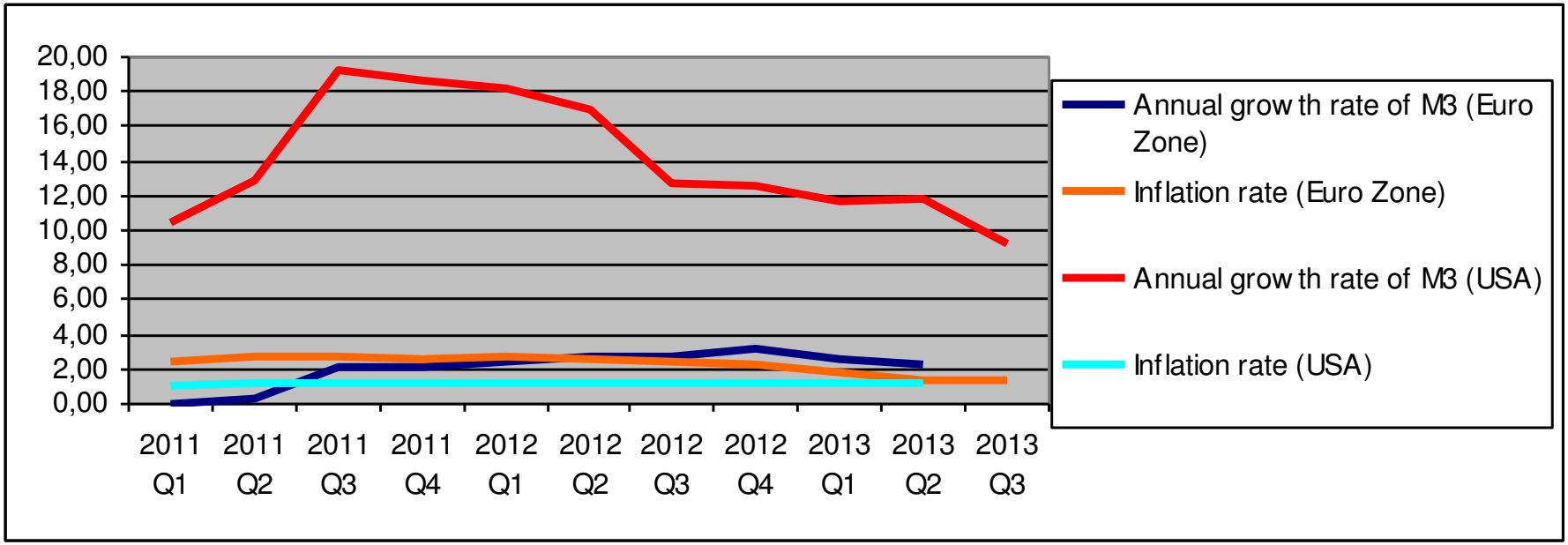
Under Fixed Exchange Rate Regime (Mundell Fleming): Expansionary Fiscal Policy Will Work

- Rise of real government expenditures (rightward shift of IS curve);
  - **increase of real interest rate**
  - = high **net capital inflows** so that there will be an excess supply in the foreign exchange market
  - **= real devaluation of the currency** (eP*/P – e in price notation: €/$ - will rise) so that
  - **net exports** of goods and services will increase
  - Equilibrium **real income goes up**; employment +

A Look at Fiscal Policy in the US

- Traditional challenge of market economies concern stabilization of output, prices; and achieving full employment
- Extreme challenge was post-Lehman Brothers situation in the US, Europe, China, Japan etc.
  - US: 2008 Economic Stimulus Act = **1,2% of GDP**
  - US: 2009 and 2010: 2.1% and 2.4% of GDP
  - EU: fiscal stimulus 1,1% in 2009, 0.8% in 2010; China 2009+; 2015: US 2015/08 + is 10% compared to €area

Fig. 6. Annual Growth Rate of M3 and Inflation Rate in Euro Zone and USA



Source: OECD

Monetary Approach to Balance of Payments: Fixed Exchange Rate (central bank has to defend parity)

- P^T* rises, hence P^T will rise (since $P^T = eP^T$*);
  - if P^T rises P is raised and hence there is an excess demand in the money market (Ph"Y>M); companies will raise exports in order to increase liquidity. Higher exports of goods = excess supply in foreign exchange market: central bank has to intervene (buying foreign exchange, paying with newly printed money)= raising money supply. Current account has improved, money supply has increased (M is endogenous)

Total Factor Productivity Growth (K capital, L labor, A knowledge, δ depreciation rate of capital; production function is linear-homogenous

- 1) Y(K,L,A):production function; 1‘)$Y=K^{ß}(AL)^{1-ß}$
  - 2)$Y=Y_K K + Y_L L + Y_A A$; Y_K is marginal product of capital (Y_L...of labor; Y_A ...of knowledge)
  - 3) With profit maximization $Y_K-δ=r$; $Y_L=w$ (real wage), Y_A= p“ (real price of innovation)
  - 1“) $\ln Y(t) = ß\ln K(t) + (1-ß)(\ln A(t) + \ln L(t))$
  - $d\ln Y/dt:=g_Y = ßg_K + (1-ß)(a+n)$; ß=rK/Y profit ratio; $a=g_A$ (g is growth rate) $n=g_L$; here a= is total factor productivity growth; empirical analysis based on **growth accounting**...a stands for process innovations; competitiveness+

Explaining Innovation Dynamics

- Process innovations
- Product innovations
- Endogenous Growth Theory explains innovation dynamics; e.g. through research and development
- Important aspect of internat. competitiveness is total factor productivity (growth);& unit labor cost W/(Y/L); nominal wage relative to labor productivity = **WL/Y** (Cobb-Douglas: W/(Y/L)=(1-ß)P; P=(W/y)/(1-ß); here y:= Y/L; with CES function different...); wage pressure stimulates labor-saving technological progress.

Fig. 7. Total Factor Productivity, 2000-2014

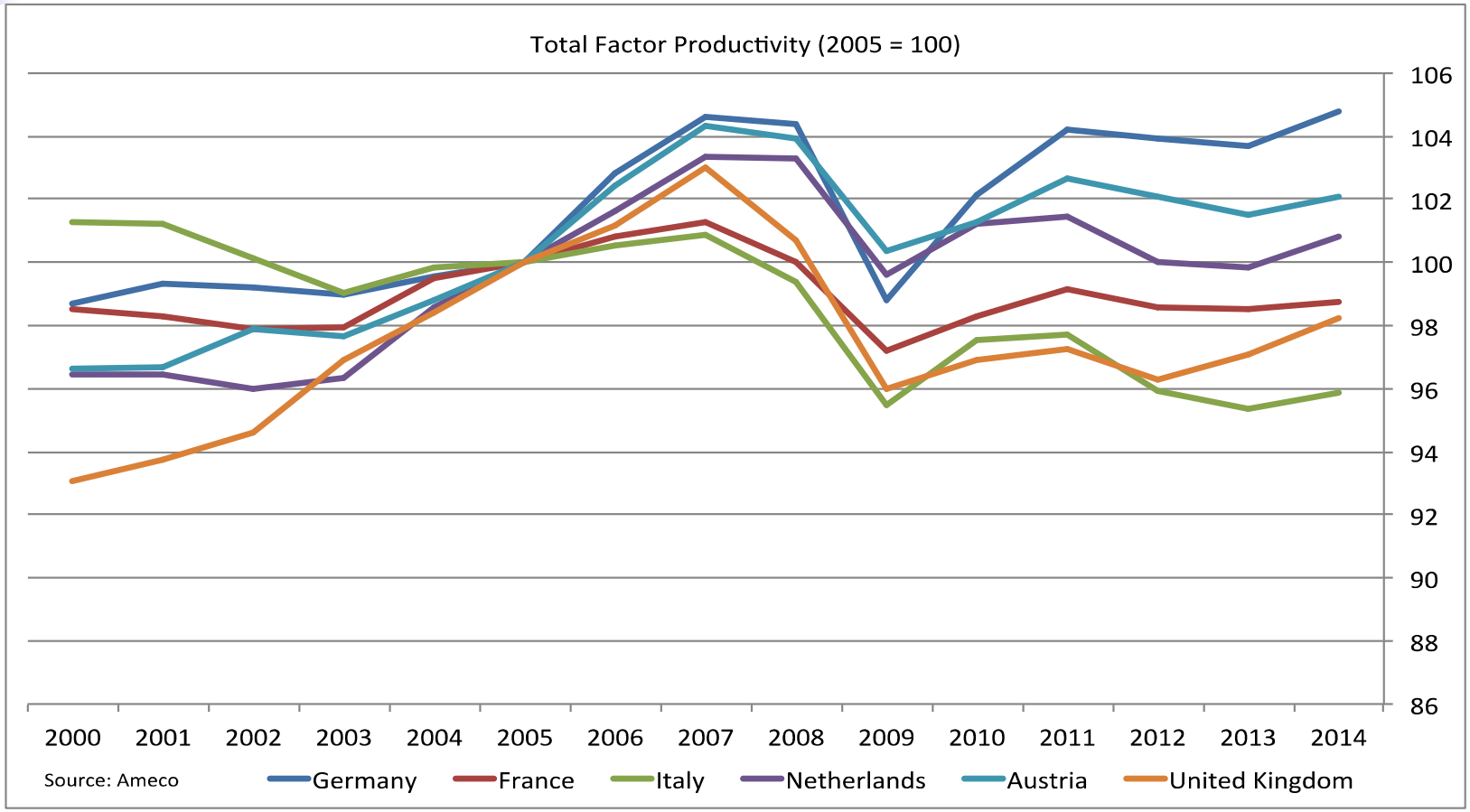


Fig. 8. Nominal Unit Labour Costs in Total Economy

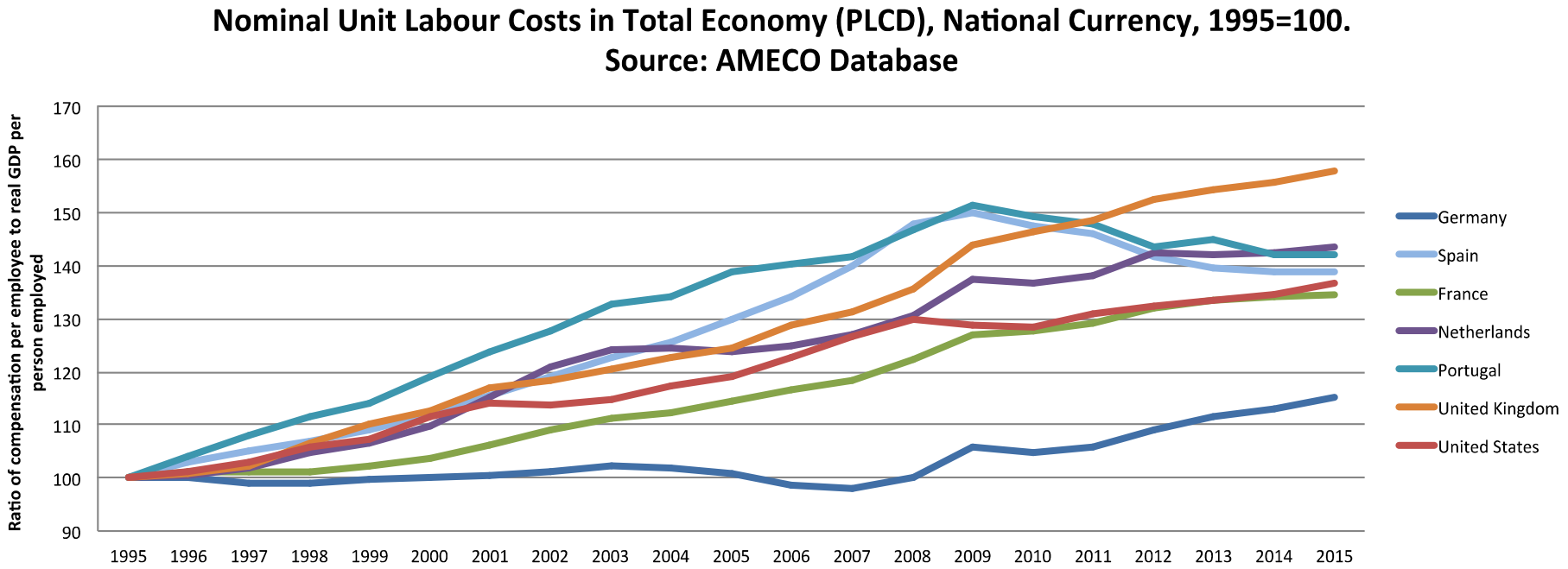
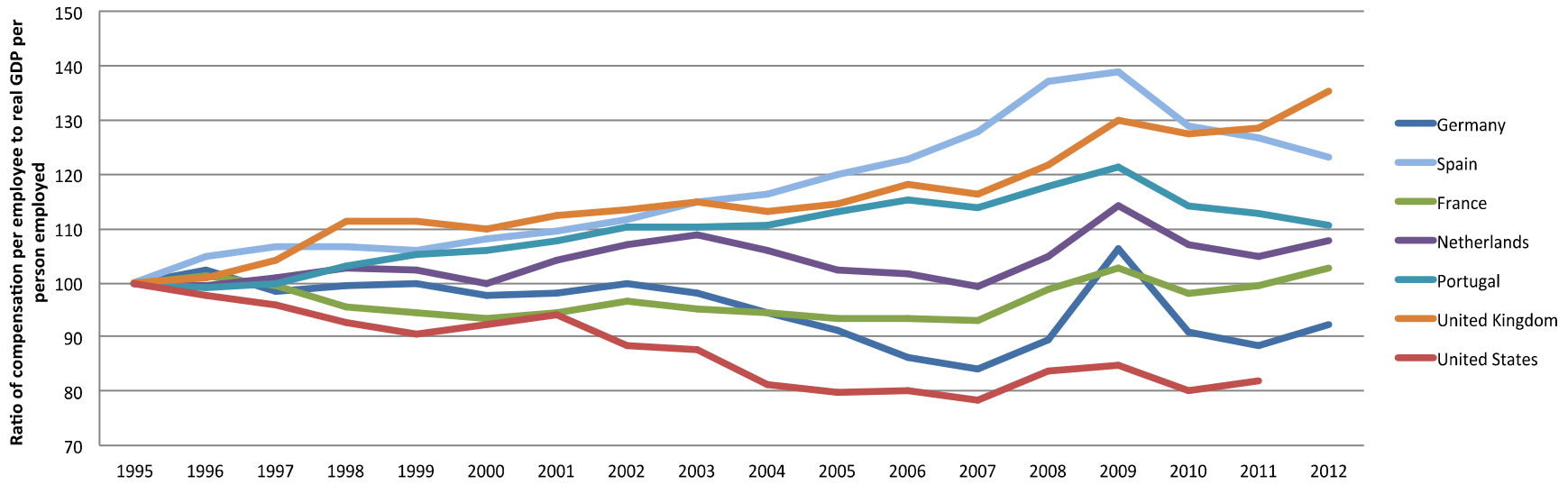


Fig. 9. Nominal Unit Labour Costs in Manufacturing Industry

Nominal Unit Labour Costs in Manufacturing Industry (PLCM), National Currency, 1995=100.
Source: AMECO Database



Oil Price Inflation...Some Microeconomic Aspects (t time index)

- Growth rate of oil price (P‟) is determined by the nominal interest rate i (H is unit cost);
- Intertemporal profit maximization (Hotelling)
  - 1) $i(P‟ - H) = dP‟^{E}/dt$; taking one unit of oil out of the resource site generates a cash flow P‟ – H; cash flow at the bank yields i(P‟-H); if the marginal resource unit is left in the ground expected yield is $dP^{E}‟/dt$. Equality sign of alternatives = max. profits
  - 2) if H is zero (Hotelling) we get i= (dP‟/dt)/P‟;

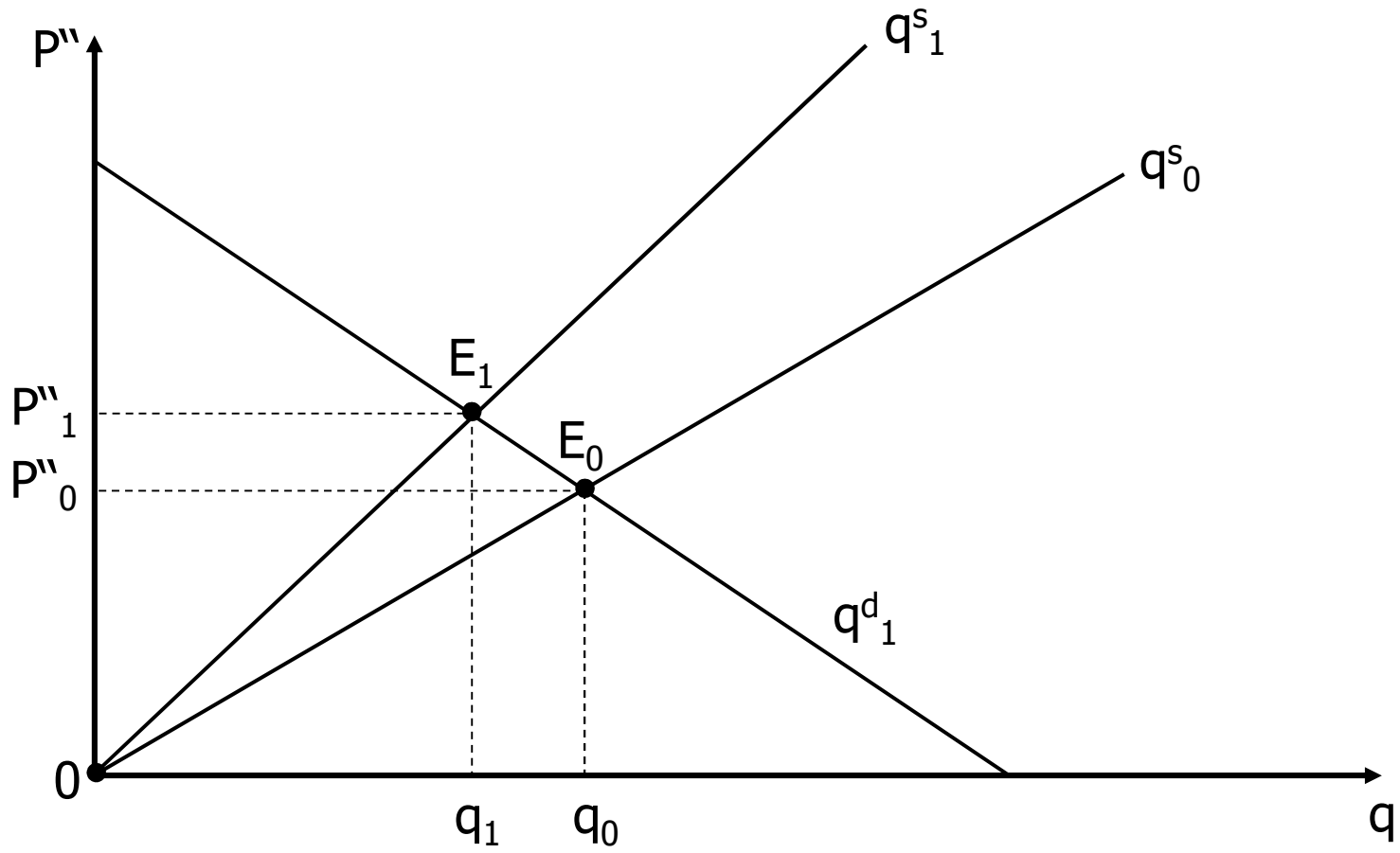
Consider Modified Hotelling (Welfens, 2011; Innovations in Mcroeconomics)

- i(P‟-H) = dP‟^{E}/dt (t is time index); divide by P‟
- i(1 – H/P‟)= π‟‘^{E}; if H=H‘q (H‘>0), q quantity
- lni – H‘q/P‘‘= lnπ‘‘^{E} ; H‘ is a cost parameter
- Hence quantity supplied q^{s}= ln(i/π‘‘^{E})P‘‘/H‘ and with i = **r** + π^{E} and π := vπ‘ +(1-v) π‘‘ (0<v<1) for case π‘=π‘‘ (constant rel. price) and with ln(1+x)≈x (small r/π‘‘^{E})
- q= (r/π‘‘^{E})P‘‘/H‘or P‘‘=H‘(π‘‘^{E}/r)q; q^{d}=V‘Y–V‘‘P‘‘/P
- **Equilibrium P‘‘ = V‘Y/((r/π‘‘^{E})/H‘ + V‘‘/P); V‘>0; V‘‘>0**
- **lnP‘‘= lnV‘ + lnY - ln((r/π‘‘^{E})/H‘ +V‘‘/P); r is real interest rate**

Will the Oil Price Always Increase...

- Certainly not; role of expectations, Y^{world} etc.
- Technological progress (Welfens, 2011)
  - $i(P" - \mathbf{H}) = (dP"^{E}/dt)(1+\mathbf{x"})$; x" is technological magnification factor that allows resource site to be profitably exploited more fully relative to physical maximum
  - Technological progress can concern cost parameter H or H' (H=H'q); and magnification parameter x" (see e.g. fracking)

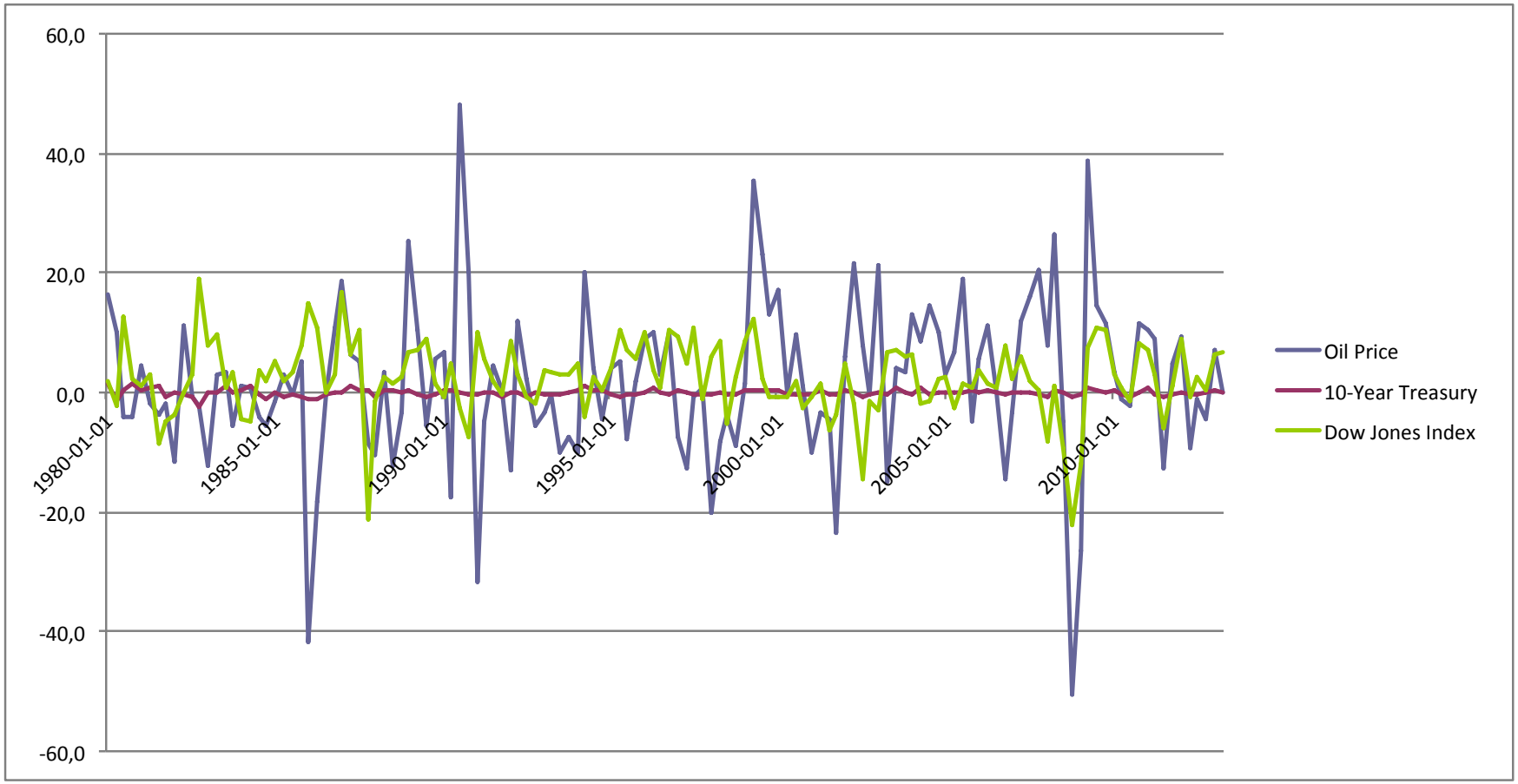
Figure: Equilibrium Oil Price
- derived from *intertemporal profit-maximization* of suppliers; rise of expected oil price inflation rate...



Role of Oil Price Inflation...

- if the growth rate of oil prices fully would determine inflation rate then the real interest rate would be zero – hence Hotelling rule not convincing: $i - g_P = r$;
  - Here inflation rate g_P may be assumed as follows: $g_P = \theta g_{P''} + (1-\theta)\, g_{P'}$ where $g_{P'}$ is the inflation rate of non-oil products; $0<\theta<1$ and indicates the share of oil in households' total consumption; is $g_{P'}$ negative?
  - In reality oil price rather **determined by a political deal** between the Saudis (OPEC) and the US...

Fig. 10. Oil Price Growth, Dow Jones Index Growth and 10-Year Treasury Interest Rate in USA



Source: Federal Reserve Economic Data

Which Analytical Elements Do We Need in Macroeconomics? (FDI is foreign direct investment; FDI plus trade; role of MNCs...)

- 1) Short-term *financial market* Branson model (e,i)
- 2) Inflation π analysis based on Phillips curve
- 3) Medium term Keynesian macro model (r, Y, e)
- 4) Solow Growth Model (other growth models; including endogenous growth model); long term per capita income y#=Y/L; and Y#
- 5) NKM: New Keynesian Macroeconomics which combines 2), modified 3) and forward-looking behavior (rational expectations)
- 6) Open economy with FDI inflows/outflows

Some Mathematical Rules

- 1) $Y = X\,Z$; $dY = ZdX + XdZ$ and $\ln Y = \ln X + \ln Z$
- 2) $Y = X/Z$; $dY = dX/Z - XdZ/Z^2$
- 3) $Y = X^n$; $\ln Y = n \ln X$
- 3) $Y = X + Z$; $dY = (X/Y)dX + (X/Z)dZ$; denoting $X/Y = x$ we can write instead of X/Z now $1-x$
- 4) $Y = \ln X$; $dY/dX = 1/X$
- 6) $d\ln Y/dt = g_Y := (dY/dt)/Y$ growth rate! (t time index)
- 7) $\ln(1+x) \approx x$ if x is very small

Additional Issues...

- Model of National/International Banking Crisis?
- Stock market price index (P‘) dynamics; price of stocks = discounted **expected** future cash flows;
  - discounting 1 € next year= 1/(1+i) as present value, $1/(1+i)^2$ for 1 € in year 2 etc., hence level of nominal interest rate plays a role for P‘
  - High volatility; problem could be intra-day/high frequency trading – most orders not executed (...flash crash?)
  - MV= PY + P‘Kθ (Welfens, 2011); if P‘=v‘P, ßY/K=r and hence K=ßY/r we can write that MV=PY(1+θv‘ß/r); lnP= lnM +lnV – lnY – θ(r)v‘ß/r; θ is portfolio turnover frequency

Implication for Deflation Analysis (2014, Euro Zone)

- $\ln P = \ln M + \ln V(r) - \ln Y - \theta(r)v'ß/r$; V is a positive function of r (with expected price stability), E denotes elasticity
- $d\ln P/dt = d\ln M/dt - d\ln Y/dt + (\theta ß/r)(dv'/dt)$

  $+ E_{V,r}dr/dt - (v'ß/r)\theta_r dr/dt + (\theta v'ß/r^2)dr/dt$; fall of the real interest rate and rise of P'/P (hence rise of v') will lead to deflation if growth rate of money supply is equal to growth rate of Y ($d\ln M/dt = d\ln Y/dt$)

  Critical point could be that $dv'/dt = v''de/dt + v''dv'^*/dt$ (v'^* US stock market price index; „arbitrage condition $P' = eP'^*$)

  Portfolio turnover parameter could also be a negative function of transaction costs/internet price variable; internet cheaper... θ goes up

Some Critical Aspects of Financial Markets

- Bias in pricing of risk possible (too low: 2004-2006 in the US; risk premium = interest rate of corporate bonds with AAA rating relative to US government bond interest rate; Euro crisis...explaining i_j(Gärtner)?
- Overshooting: exchange rate (Dornbusch model); eP*=P through arbitrage, so that purchasing power parity exchange rate e= P/P* in the long run; short-term e_t can differ from PPP exchange rate: over-shooting related to expectation dynamics; q*=eP*/P
- **Self-fulfilling prophecy** in financial markets

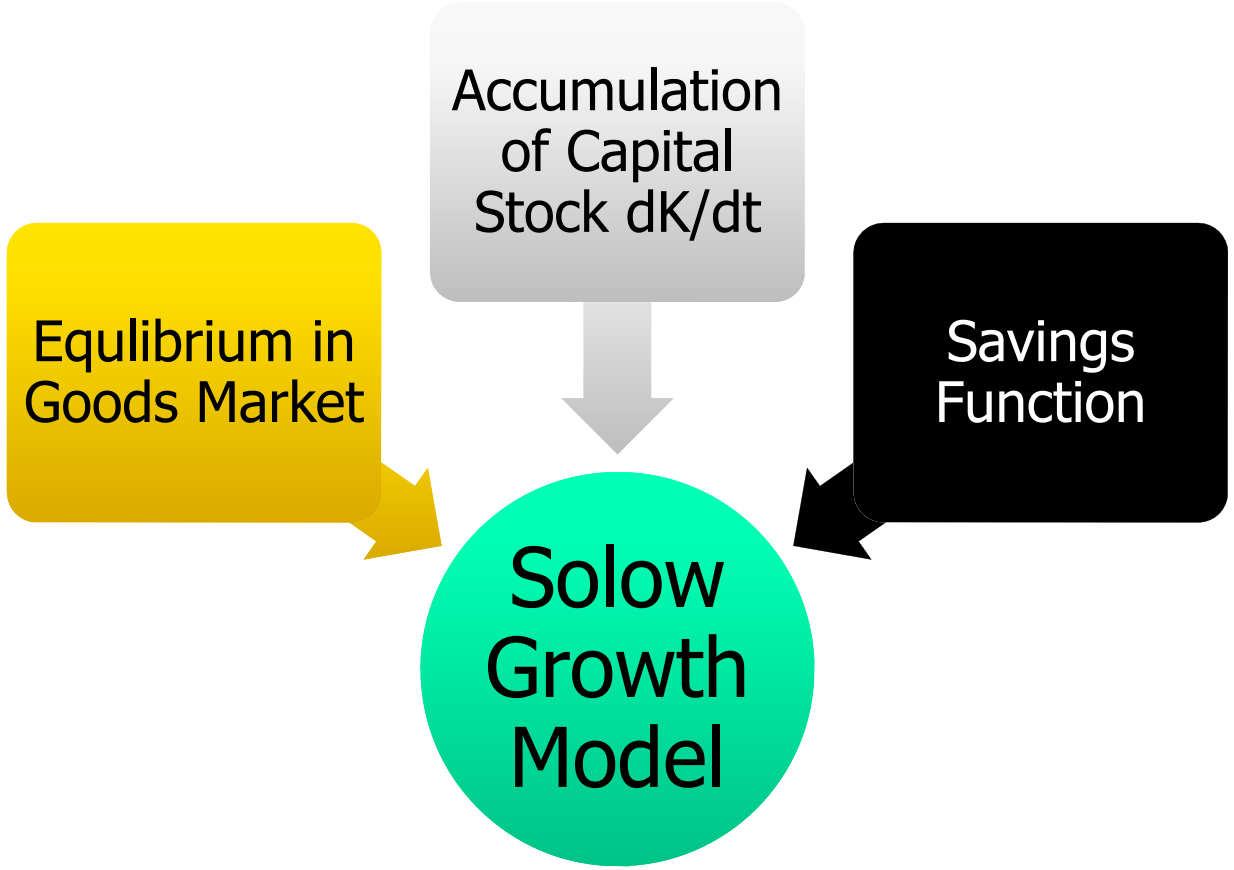
A Look at Inflation (Quantity Equation)

- Inflation rate g_P (we also use π);
- If we consider $MV = PY$ (V as velocity that is assumed to be constant) we get (with g for growth rate $g_M := d\ln M/dt$):
  - $g_M + 0 = g_P + g_Y$ and therefore
  - $g_P = g_M - g_Y$; the inflation rate (in the long run) is equal to the difference of the money supply growth rate g_M and the real output growth rate g_Y (if long run output growth is determined in a neoclassical growth model we have $g_Y = n+a$ (sum of population growth rate (n) and growth rate of knowledge (a))

Recall Production Potential; Macroeconomic Cobb Douglas Production Function (or CES...)

- **$Y = K^{ß}(AL)^{1-ß}$**; K capital, A knowledge (Harrod-neutral progress...), L labor, $(0<ß<1)$;
- **ß is the output elasticity of capital**; in a setting with competition in goods and labor markets – plus profit maximization – (real interest rate r =marginal product of capital = $ßK^{ß-1}(AL) = ß/k'^{1-ß}$ ($k' := K/(AL)$); real wage rate w:=W/P= marginal product of labor; **ß is also equal to the income share of capital rK/Y**

Neoclassical Growth Model: (L is growing over time; and knowledge A; sometimes A=1 constant)



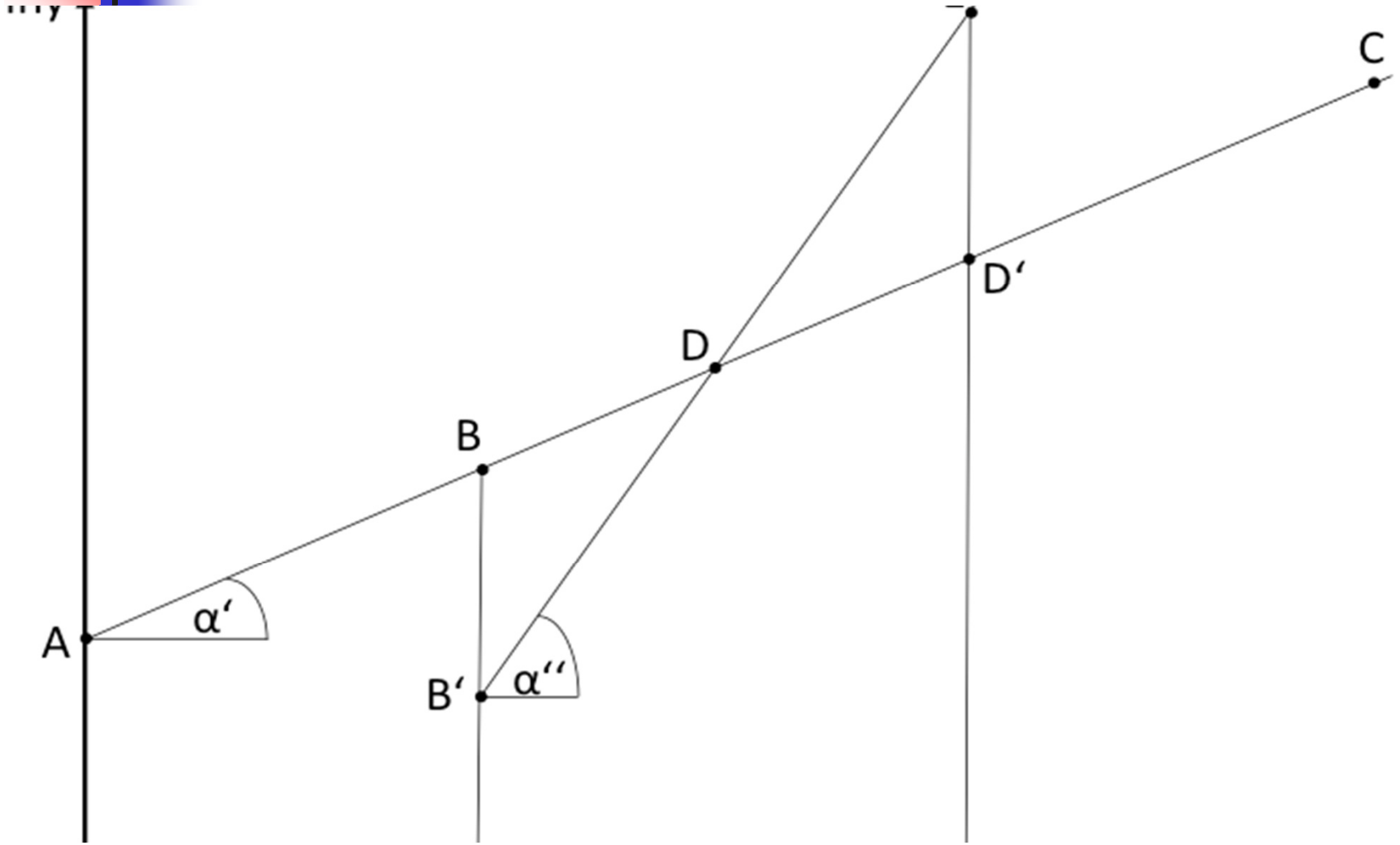
Consider the Building Blocs (in simple case with A=1):$Y=K^{\beta}L^{1-\beta}$; $y:=Y/L=k^{\beta}$ (capital intensity k=K/L; t is time)

- Savings function (1) S= sY (0<s<1; s:=1-c); and obviously (1.1) S/L = sy = sk^{β}
- Goods market equilibrium condition: Savings **(2) S = gross investment dK/dt +δK** (δis depreciation rate= reinvestment rate)
  - (2.1) S/L = (dK/dt)/L +δk;
  - (2.2) dk/dt = (dK/dt)/L – nk (where n:=(dL/dt)/L)
  - (2.3) dk/dt = sk^{β} – (n+δ)k; long run equilibrium (steady state #)means dk/dt=0; **$k\#=s/(n+\delta))^{1/1-\beta}$**

Per Capita Income in Steady State (recall $y=k^{\beta}$); e‘ Euler number:

- y# =$(s/(n+\delta))^{\beta/(1-\beta)}$
- (Y)# =$(s/(n+\delta))^{\beta/(1-\beta)} L_0 e^{‘nt}$; L_0 is initial population;
- Level of the growth path in lnY-t diagram:
- Growth rate of Y in steady state is n since $\ln Y = (\beta/(1-\beta))\ln(s/(n+\delta)) + \ln L_0 + nt$
- **dlnY/dt=n; is the growth rate of Y#**

Level of Growth Path and Growth Rate (lny –t graph, OA= level of growth path; tg α‘ is growth rate n)



Neoclassical Growth (Solow) Model: Y is GDP, L is labor, K capital, s savings rate

- Growth of real gross domestic product (Y)
- **Neoclassical Model** uses production function and a simple savings function; Solow model imposes equilibrium condition on goods market to determine the **level of the growth path** & the growth rate itself
  - In a setting with constant growth rate n of population (and hence labor input; A=1) the *long run growth rate of Y is n*
  - In a setup with exogenous technological progress rate (a) and population growth the steady state growth rate of Y is given by a+n (at first we will ignore technological progress)
  - The level of growth path Y‟=L(s/(n+δ)); δ depreciation rate of capital (if ß=0.5)

Explaining Long Term Dynamics in Market Economies **and** in Socialist Countries...

- Market economy: Assume production function 1) $Y(t)=K^{\beta}L^{1-\beta}$; $0<\beta<1$; 1‘) $y:=Y/L=\mathbf{k^{\beta}}$; **$k:=K/L$,** t time index
- Savings function 2) $S= s(1-\tau)Y$. **Equilibrium** condition goods market:
- 3) $dK/dt +\delta K= s(1-\tau)Y$; δ depreciation rate; divide equation 3) by L
  - 3.1 **$(dK/dt)/L$**$+\delta k= s(1-\tau)\mathbf{k^{\beta}}$; this picks up the equilibrium condition from 3)& takes into account 1‘): Gross per capita investment =per capita savings
  - 4) $dk/dt =$ **$(dK/dt)/L$** $- nk$; $n:= (dL/dt)/L$ is the growth rate of population;4) is mathematical rule for differentiation of $k:=K/L$
- 5) $dk/dt = s(1-\tau)k^{\beta} - (n+\delta)k$; set for simplicity $n=0$; long run equilibrium requires **$dk/dt=0$**; 5‘) $k\#=(s(1-\tau)/\delta)^{1/(1-\beta)}$; steady state (#)/long run **6) $y\#=(s(1-\tau)/\delta)^{\beta/(1-\beta)}$;** **consider $\beta=0.5$**

Compare Growth Model (long run) and Keynesian Medium Term Macro Approach (note: savings rate s= 1-c)

- **Using y:=Y/L: (6‘) $Y\# = L(s(1-\tau)/\delta)^{\beta/(1-\beta)}$**
- **Keynesian approach** (Y is demand-determined)
  I) $Y = c(1-\tau)Y + v'(\beta Y/K - \delta - r) + \delta K + G$; $v'>0$;
  investment proportinate to marginal product of capital **$\beta Y/K - \delta$** minus r;
- money market equilibrium: $M/P=hY/(h'r)$; $h'':=h/h'$ replacing r in goods market equilibrium gives
  - $Y = ((K-v')\delta + G))/(1- c(1-\tau) - v'\beta/K + h''v'/(M/P))$
  - $Y = ((K-v')\delta + G))/(\mathbf{s}(1-\tau)+\tau - v'\beta/K + h''v'/(M/P))$

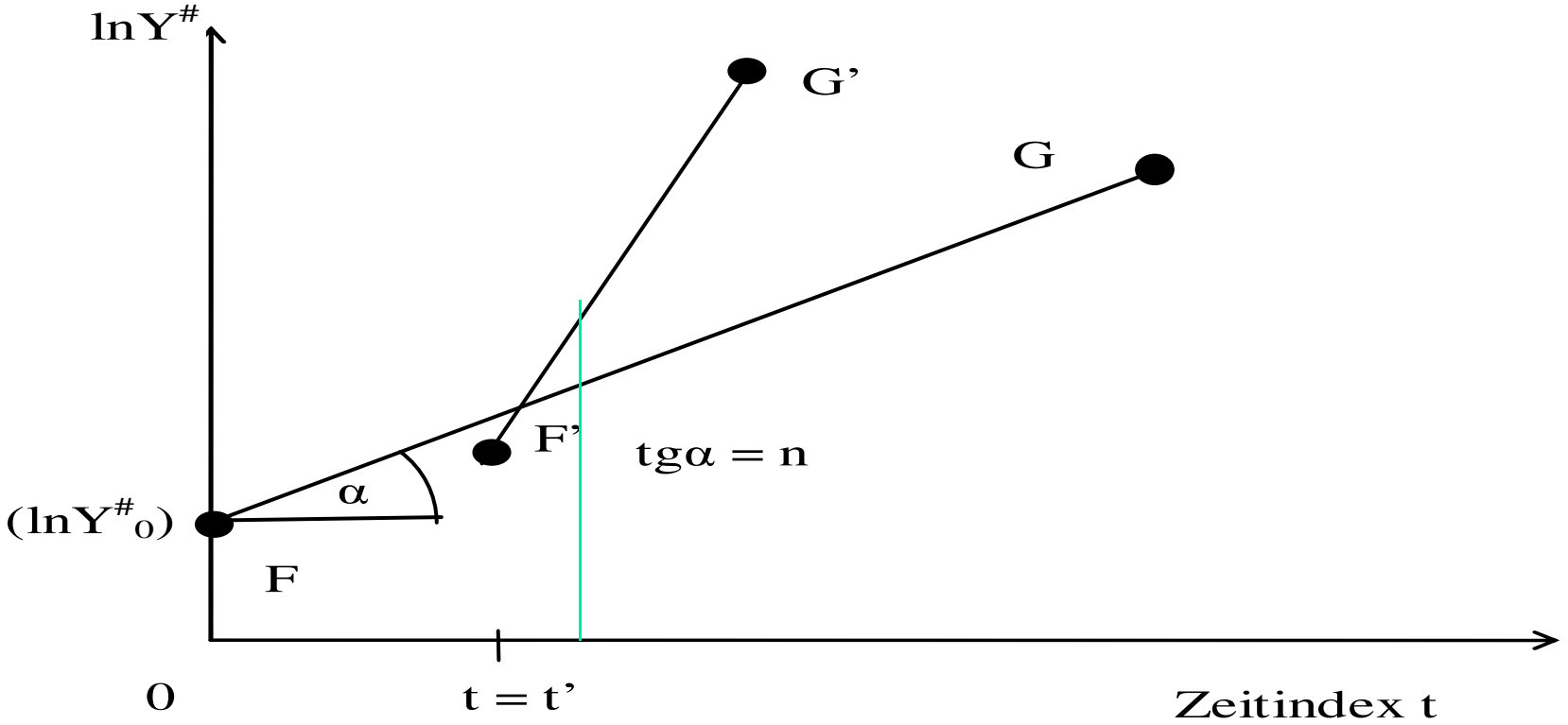
Key Insight From Neoclassical Macro Model (y:= Y/L); ß=0,33

- **6) $y\#=(s(1-\tau)/\delta)^{ß/(1-ß)}$;6‘) $Y=L(s(1-\tau)/\delta)^{ß/(1-ß)}$**
- **6“) $\ln Y = \ln L + ß“(\ln s - \tau - \ln\delta)$;$ß“:=ß/(1-ß)$; $\ln(1-\tau) \approx \tau$**
- **Long run per capita income y is a positive function of the savings rate; a negative function of tax rate; negative function of capital depreciation rate; positive function of ß (next: e‘ Euler number; A is knowledge, t time)**
- **If $Y=K^{ß}(AL)^{(1-ß)}$; $A(t)=A_0e^{‘at}$; $L(t)=L_0e^{‘nt}$**
- **7) $Y\#=e^{‘(a+n)t}A_0L_0(s(1-\tau)/(a+n+\delta))^{ß/(1-ß)}$**

blue term is the level of the growth path

Level of Growth Path (point F) and Growth Rate (tang α)

Effect of an Increase in Population Growth Rate n (in t')



Key Question in Growth Theory

- In the Solow (neoclassical) model the growth rate of per capita income determined by progress rate (a)
  - **Endogenous growth theory:** how to explain technological progress a; e.g. through R&D expenditures (relative to GDP); or the use of information and communication technology; or higher education (natural sciences +...)
  - In poor countries explanation of progress rate a also by looking at international diffusion/catching-up, FDI inflows etc. (bring some technology transfer); FDI outflows also potentially important – *if asset-seeking FDI* (EU firms in US)

Market Economy with Institutions (Institutional Capital H (Welfens, 2004); 0<ß‘<1)

- $Y = H^{ß‘}K^{ß}L^{1-ß-ß‘}$
- $y=h^{ß‘}k^{ß}$; $S/L = s(1-\tau)Y/L$; $h:= H/L$
- $dk/dt = sh^{ß‘}k^{ß} -(n+\delta)k$; $k\#=(sh^{ß‘}/(n+\delta))^{1/1-ß}$
- $y\# = h^{ß‘}(h^{ß‘}s(1-\tau)/(n+\delta))^{ß/(1-ß)}$
- $Y = Lh^{ß‘}(h^{ß‘}s(1-\tau)/(n+\delta))^{ß/(1-ß)}$
- Hence institutional capital raises the level of the growth path of the economy; also institutional capital could stimulate **growth rate of population or of innovations…**

Endogenous Growth Theory and New Growth Theory

- Endogenous Growth (growth rate of knowlede is „a‟):
  - Explaining the growth rate of knowledge a by a technological progress function (Kaldor already);

    1) a= vR&D/Y + v‘j‘a*+ v“x +z“FDI/Y (WELFENS, 2014)
  - Coe/Helpman: analysis of import-based technology spillovers (weighted imports: foreign R&D intensity feeds into importing country‘s innovation dynamics; or emboddied tech.)
  - R&D sector: Modeling of the innovation process in which society has to invest resources (see v‘=R&D/Y: Welfens, 2014)
  - $da/dt = v'(a^*)^{\lambda} - \delta''a$; $a\# = (v'a^*/\delta'')^{(1/1-\lambda)}$; $0<\lambda<1$
  - **Or** $dA/dt = v'A^*(A)^{\lambda} - \delta''A$; $A\#=(v'A^*/\delta'')^{1/(1-\lambda)}$ technology convergence if v‘=δ“.

Endogenous Growth Model (Aghion et al.)

- Ingredients: Utility-maximizing households (infinite time horizon); $U(C) = (C^{(1-\varepsilon)} - 1)/(1-\varepsilon)$; intertemporal elasticity of substitution $\eta = 1/\varepsilon$;
- Relevant Euler equation is:
  - $-\varepsilon(dC/dt)/C = \rho - r$ (r is real interest rate)
  - Note $(1/(1+\rho)$ is discount factor; $\rho > 0$

Growth rate $g = (\rho - r)\eta$

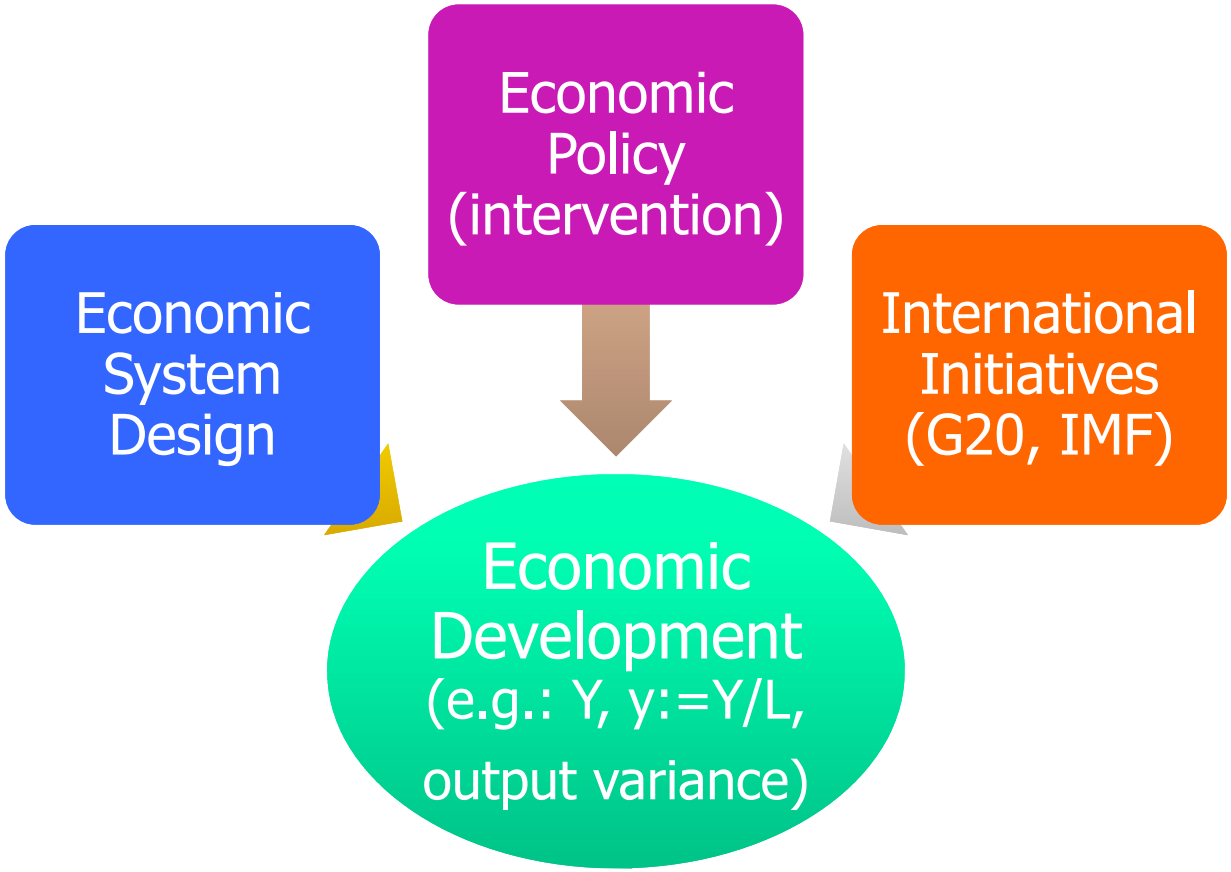
Aghion/Howitt (2009, pp.74-76)

- In the context of a simple **Romer model** – with λdenoting a productivity parameter in the research sector **where product varieties are produced that feed into output** (output parameter α"<u>></u>0) we get for growth rate g in steady state:
- g =(α"λL – ρ)/(α"+ε);
  - a bit strange that size of economy (L) affects g

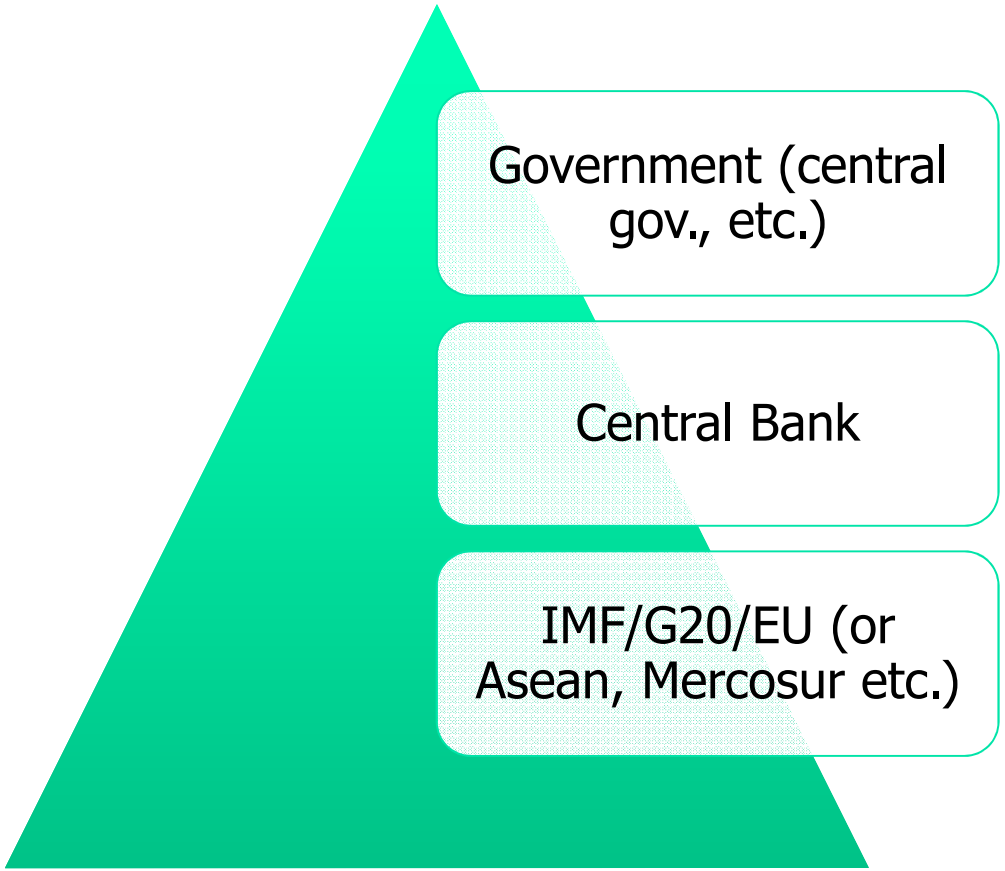
Piketty Debatte Since 2014: Book Capital in the 21st Century...

- **Thomas Piketty argues:** Capital income share in 19th century much determined by land, has increased over decades; in the 20th century some decades with decline of capital income; rising again e.g. in the 1990s and early 21st century in US, UK, France (land no longer so important)
- Piketty: **If r exceeds g capital income share is rising**
- How could such episodes be explained? Paper (IZA) Welfens, 2015: consider role of size of R&D sector ß‘ (ß‘ is share of workers in R&D sector); output elasticity of capital is ß+ß“ß‘ (ß“>0); Kaldorian **progress function da/dt = λ“ß‘a^{v} – λ‘a** (0<v<1). One can derive for golden age – maximizing per capita consumption in sttdy state – optimal ß‘= (s-ß)/ß“

Government Has Impact Upon Economic Development Through



Main Government Institutions



Role of Expectations

- Current policy measure = intervention plus impulse for **expectations**
- Future policy intervention: efficiency and effectiveness partly rely on **reputation**
  - What has been announced? Keeping promises = basis of reputation; how strong opportunistic behavior?
  - Communication policy of institutions (e.g. FED, ECB, BoE): Explain what you do...(Eijffinger,2014)

Role of Multi-layered **Government** (some basics...)

- Theory of Fiscal Federalism (OATES, 1999, in JEL)
  - on efficiency grounds mobile units should pay taxes for benefits obtained – in this perspective local government should set adequate prices; property taxation can play an important role (e.g. a city that has built a dam should charge implicit flood protection prices proportionate to the market value of the house).
  - Federal grants given to states (looking at US) should be such that spillovers are adequately internalized; EU countries(?); state innovation policy..
  - Central government: Defence, part of social security, income redistribution; stabilization policy

Selected Statistics (annual data)

- (I) Growth rate real output: US, UK, Germany, France, Spain, Italy, China, Korea, Australia, Indonesia, Brazil, Russia 1990-2020
- Unemployment rates:
- Inflation rate (as I) 1970-2012
- Total factor productivity growth EU big 5, US
- Share of Product Innovations by EU Country
- Income Tax Rate (OECD countries, 1970, 80, 90, 2000, 2010)
- Income Tax Rate plus Social Security Contrib.
- *HDI index* (Top 20, Bottom 10), www.worldbank.org

Role of Government

- **Fiscal policy**: G, income tax rate τ, VAT (value-added tax) rate τ‘, social security contribution rate τ“
- **Monetary policy** (M stock of money)
- **Innovation policy** (v‘ is product innovation)

Model of a Closed Economy (C=cY consumption demand); gross investment is δK -b"r; δ depreciation rate of capital

- is useful to understand the world economy
  - which is a closed economy
  - Goods market equilibrium condition is given as

1) Y = cY +δK – b"r + G; 1.1) sY = δK + G – b"**r**

- 2) Money market equilibrium 2) M/P = hY – h'r; 2.1) r=**h"Y – (1/h')(M/P)**; h":=h/h'. 2.1) in 1.1) gives
- (s+b"h")Y = δK + G **+ (b"/h')(M/P);**

multiplier dY/dG =1/(s+b"h"); dY/dM=1/(sh'/b" +h)

Expansionary fiscal policy & monetary policy raise Y

Fiscal Policy

- Expansionary fiscal policy (dG>0, or dT<0; or dτ<0; reduction of income tax rate) in order to raise aggregate demand
- Expansionary monetary policy (dM>0; M is nominal stock of money)
- in a ***growing economy*** d(M/Y)>0
- Crowding-out problems(?); higher G is financed

Basic Inflation Problems

- **Fisher equation MV = PY**; V is velocity; V=V(i); volocity is a positive function of nominal interest rate i
- M/P = V‘Y; V‘= 1/V(i); i is the nominal interest rate. For simplicity assume V‘ constant
- P = M/(V‘Y)
- $g_P = g_M - g_{V'} - g_Y$; if V‘ and hence V is constant the inflation rate $g_P = g_M - g_Y$

Problem of Currency Substitution

- Overall money supply M‘= M + eM*
  - Typcial situation with high domestic inflation; often black currency exchange rate (higher than official rate)
  - e is the nominal exchange rate (in price notation: euro/$); M* is foreign stock of money in country I.
  - A rise of e – a currency depreciation – raises the overall money supply M‘; the price level P can increase due to rise of M, e or M*!

Where did we see currency substitution

- a) Latin America: high inflation countries of the 1970s; 2014 Argentina (with black currency market)
- b) in socialist eastern European countries in the crisis of the 1980s – collapse of socialism in Poland in late 1989; sept. 1989 Mazowiecki government; with Leszek Balcerowicz as minister of finance. Later president of the Polish central bank. 1991 collapse of the Soviet Union; new Russia, new country Ukraine

Rise and Collapse of Socialist System and the USSR, respectively

- Russian Revolution of 1917: Collectivation of capital, farms – millions starved in the 1920s and 1930s
- USA 1929-1933 almost collapse of the world's biggest market economy: Output decline -25%
- Russian modernization of the economy trough central planning, growth of electricity, schooling, using labor from agricultural surplus sector for industrialization

Which problems emerged in socialist economies?

- Korea, Taiwan, Singapore, Hongkong catching-up with growth rates of 7% or more over decades;
- but slow growth in low per capita income countries of eastern Europe in the 1980s;
  - terms of trade of socialist countries declined (competing against NICs; see Korea, Taiwan etc.).
  - Elastic labor supply from agriculture no longer existing;
  - endogenous money supply growth and rising inflation pressure emerged; growth of socialist shadow economy and massive **corruption; inflation** pressure**, output decline!**
  - massive depreciation in black foreign exchange market

Socialist System: socialist command economy; 1917 Soviet Union – until 1991

- Government-owned firms, now bankruptcy
- Firms should (over)achieve output plans
- Central planning bureau allocates inputs to firms (discrimination of services – due to Marx; poor innovation record)
- No domestic competition= poor quality
- Money plays no active role; no unemployment
- Not much private ownership = poor incentive to invest and to use assets efficiently
- Monopoly external trade sector
- Monopoly central bank: with banks being a subsidiary of the central bank

Politico-economic Perspective on Decline of Socialist System

- Soviet reformers (Gorbatchev's economic reform team) did not understand key challenges in the 80s; military rivalry US-USSR
- Lack of innovation dynamics in socialist countries; declining terms of trade: countries had to export more goods in order to obtain required import volume – consumption declines, working motivation falls, queuing gettting worse, shadow economy growing further, corruption, collapse of the system; strikes (Solidarnosc Poland 82, Martial Law. 89: Gorbatchev: end of Cold War
- Lack of elastic labor supply in agriculture implied that socialist firms would outbid each other in order to attract workers from other firms to fulfill central plan; monetary credits for firms increased=inflation pressure, output decline, collapse of system

Crisis of socialist countries 1980s

- **Expansion of black markets** – in socialist shadow economy market price is higher than state-administered price in the official system (in contrast to market economy)
- Black foreign exchange market: typically **hidden devaluation of economy** =inflation; advantage for households with hard currency income; **inequality in society is rising**
- Economic stagnation, open inflation

What Market Economies Can Deliver If System Is Stable (t time index)

- Maximize **per capita consumption C/L** in a simple growth model (population growth rate: n)
  - **Golden rule: growth rate of output (n) should be equal to the real interest rate**: $C/L = Y/L - I^{gross}/L$; savings $S = sY$; goods market equilibrium condition $S = dK/dt + \text{reinvestment}\delta K$; if $Y=K^{\beta}L^{1-\beta}$ $(0<\beta<1)$: $y\#:=Y/L= (s/(\delta+n))^{\beta/(1-\beta)}$; golden age: **$s=\beta$!!**
  - Golden rule not fully clear in an open economy with cumulated FDI inflows: C = cZ where Z is gross national product (not equal to GDP: Y)!

1. Recalling the Basics

- **Open economy: big vs. small; big-big!!**
- Trade (tradable goods vs. non-tradable goods)
- Capital flows (portfolio capital flows; or foreign direct investment of Multinational Companies – the latter almost never considered)
- Financial markets in a nutshell = one interest rate that reflects **perfect financial markets:** BUT lessons from transatlantic banking crisis...

Four basic + 2 additional constraints for economic policy

- 1a) **Domestic equilibrium** = full employment
- 1b) Domestic monetary equilibrium: stable P
- 2) **External equilibrium** =**current account balance;** we have to make distinction between fixed exchange rate and foreign exchange rate
- 3) **Government budget constraint**
- 4) **Ecological constraint** (global warming problem)
- 5) Government must find majority – in democracy
- 6) Get along with *International Organizations* (IMF, OECD)

Government Budget Constraint (r is real interest rate; D^n is nominal debt of government)

- *$G + rD^n/P = \tau Y$; budget constraint if deficit=0*
- *Assume that $G/Y = \gamma$; defined D^n/P as real debt*
- *$\tau = \gamma + rD/Y$; define D/Y:=b" hence*
- *$\tau = \gamma + rb$"; the expected income tax rate*

therefore is the sum of the expected G/Y and the product of the real interest rate r and the debt-GDP ratio b"; if b" is 30% and r is 4% the income tax rate is 1,2% higher than with 0 debt; *if b" is 100%, r is 6%, the tax rate is raised by 6 points!*

Full Employment (Y^d is aggregate demand)

- If labor markets for skilled labor and **unskilled labor** are in equilibrium we have full employment;
- In simple Keynesian model (without inflation) – with Y^d determining Y - there is homogenous labor (L_0):
  - Goods market equilibrium: Y = C(Y-T)+ I(r) + G; T is tax revenue; Y-T disposable income, r is the real interest rate (nominal interest rate minus inflation rate); production function $Y=K^{ß}L^{1-ß}$; $0<ß<1$; $L^d= Y^{ß"}/K^{ß/(1-ß)}$; $ß"=1/(1-ß)$. Aggregate demand should raise Y to level required for $L_0=L^d$.
  - Monetary policy can lower r, raise investment, hence Y^d; fiscal policy can raise Yd through higher G, lower T (or τ income tax rate)

In medium term Keynesian model with price level P is exogenous

- Money market equilibrium (M money stock):
  - 1) M/P = hY/(h‘r); 2) r = h“Y/(M/P); h“:=h/h‘; money market determines equilibrium intererest rate which in turn will determine investment that in turn will determine Y and Y determines C(Y-T)
  - Alternative (Welfens, 2013) is long run assumption from profit maximization r=ßY/K (marginal product of capital); inserted in 2) we get equation
  - 2.1*) M/P = h"K; given K, M we have: P=M/(h"K) or Inflation rate $g_P = g_M - g_K$; g is growth rate in %*

Inflation and Deflation

- Inflation is defined as a more than one-off increase of the output price level or the consumer price level (P)
  - **Increase of VAT tax rate** = one-off increase of the price level, but not inflation
  - **Measuring inflation:** on the basis of a representative consumer goods basket
  - Oil price „inflation" in OECD countries in the 1970s (quadrupling oil prices 1974, 1979)? Energy-intensive goods will be more expansive, other goods could become cheaper (?). Counter argument: all prices are sticky, „energy everywhere"

Inflation effects

- Inflation clouds the market economy‘s language of relative prices; with inflation there will be inefficiency in the allocation of resources
- Inflation favors the lender (if real interest rate is depressed – as in a period of unanticipated acceleration of inflation; adaptive inflation expectations? „Surprise inflation“ (rise of growth rate of money supply: μ) by central bank with weak credibility?
- Inflation=taxing the holding of nominal money stock; real seigniorage $(dM/dt)/P = \mu(M/P)$ where $\mu=\pi+g_Y$; consider that M/P=f(inflation rate)...

Deflation:

- More than one-off decline of price level
- Deflation causes problems:
  - Allocation inefficiency (relative price changes versus absolute price decrease)
  - Consumers postpone consumption – waiting for goods to become cheaper = reduction of aggregate demand $C_t = C(Pt+1/Pt, M/P)(1 - (D^n/P)/Y)$
  - Investment declines as $I(r, D^{firms}/P)$; as real debt increases net investment will decline; imperfect capital markets

Phillips Curve

- u = u# - b“π (conventional Phillips curve); u# is the natural/long run rate of unemployment that is determined by structural traits of the labor market;
- Modified Phillips curve (with π^E for expected inflation rate; only unepected inflation helps...)
  - u = u# - b“$(\pi - \pi^E)$; b“>0; long run $\pi = \pi^E$; hence u=u# in the long run. Higher expected inflation rate shifts the conventional short term curve downwards; consistent with **Lucas Supply Curve: Y = Y# + v“$(\pi - \pi^E)$**

Rational Expectations: Muth

- In a stochastic world market participants will expect on average the correct value of macro variable; e.g. expected inflation rate = true inflation rate plus white noise error term (white noise= normal Gaussian distribution; 0 mean, 1 standard deviation).
- Lincoln: you can fool some people some time, but not all the people all the time (MILTON FRIEDMAN!)

Modern is Rational Expectations plus other elements

- Intertemporal optimization calculus of households and companies (profit maximization)
  - Time horizon: infinite time periods
  - Future utility (households) or profits (firms) are discounted on the basis of the time preference (or the interest rate)
  - Expectations will matter...; **except in neoclassical growth model.**

Define the Goals of Economic Policy in Quantitative Way; we assume $Y^*=K^*\beta^*(A^*L^*)^{1-\beta^*}$; $0<\beta^*<1$; capital income β^*Y^*

- Operationalize – indicate concept of measurement
  - Price stability (e.g. **core** inflation rate below 2%);
  - **Unemployment rate u** (registered unemployed/gainfully employed or one can rely on household survey data); **long run (#) rate u# about 4%**

GDP versus Gross National Product (GNP) as Policy Goal

- Economic growth: Real output (GDP) = Y;
- **real income Z** = Y plus balance of net international income (e.g. dividends accrueing from from abroad; asymmetric foreign direct investment means country I is the only FDI source country); **thus GNP is**

  $Z = Y + \alpha\beta^* Y^* q^*$; α is the share of (home) country I investors in foreign capital stock; * foreign, P price level, $q^* := eP^*/P$ has dimension domestic good units per foreign units.

  - **αß*Y*q* is the dividend accruing from abroad – expressed in country I goods units**

In an economy with both outward and inward foreign direct investment (FDI)...

- Role of gross national income is quite important since consumption depends on Z; exports, imports are proportionate to Z* and Z, respectively
- The assymetric FDI case (only outward FDI)
  - **Z = Y+ αß*Y*q*;** *factor markets competitive*
  - **The symmetric FDI case**
  - **Z*** = **Y*(1 -αß*) +α*ßY/q*;** and in country I:
  - **Z = Y(1 - α*ß) + αß*Y*q*;** note that a real depreciation will raise real profits from abroad

World Economy or country I/II

- Macroeconomic analysis for the **world economy** = closed economy
- Macro analysis for small open economy = all foreign variables are given; not effect of Y (etc.) on Y* and other foreign variables
- Macro analysis for two big countries:
- Macro analysis for regional integration club (EU, ASEAN, MERCOSUR, NAFTA...)

Equilibrium Output of World Economy (WELFENS, 2011);τincome tax rate,δis capital depreciation rate, gross inv. δK -λr

- (1) $Y = c(1-\tau)Y + (\delta K - \lambda \mathbf{r}) + G$; $c+s+\tau=1$
- (1.1) $r = (1 - c(1-\tau))/(\lambda Y) + (\delta/\lambda)K + G/\lambda$
- (2) $M/P = hY/(h'r)$; hence (2.1) $\mathbf{r} = hY/(h'M/P))$
- (1.2) $h''Y/(M/P) = (1 - c(1-\tau))/(\lambda Y) + (\delta/\lambda)K + G/\lambda)$; here $h'' := h/h'$; $m := M/P$
- (1.3)$\mathbf{Y}$ = $((\delta/\lambda)K+G/\lambda)/((1-(1-s-\tau)(1-\tau))+h''/\mathbf{m})$
  - Y is raised by higher G and higher m; rise of savings rate **will reduce** the medium term equilibrium **Y**

Budget Constraint (# denotes the long run „steady state"):

- Consider the government budget constraint (with stock of real government debt B/P; B is nominal debt, t is time index):
  - G + rB/P –τY = (dB/dt)/P; define G/Y:=γ
  - G/Y + rb – τ = (dB/dt)/(PY); let us assume that deficit-GDP ratio is constant, namely v
  - DOMAR (1944) has shown that b#= v/g_Y; if one assumes/shows that growth rate of real output g_Y is equal to the sum of technological progress a and the population growth rate n we get: **b#=v/(a+n)**
  - **The long run(expected?)**τ=γ+**v**((r/(a+n)) – 1)

Domar Rule (AER 1944): deficit, output growth, debt-GDP ratio

- Consider an economy with constant growth of GDP, namely g_Y, and a constant deficit-GDP ratio d‘ then the long run debt-GDP ratio (b) is given (# for long run) by
  - **$b\# = d'/g_Y$**
- Deficit-GDP ratio of 1% and real output growth rate of 2% implies that b will be 0.5 (read 50%); if the interest rate is 6% the interest expenditures/GDP ratio will be 3%.

Intertemporal Government Budget Perspective (B is nominal stock of government debt; t time index, T is tax revenue in real terms)

- **Current budget constraint**; r is real interest rate; debt-GDP ratio b:= (B/P)/Y; assume P is constant:
  - 1) G – T = (dB/dt)/P – rB/P; divide by Y and let us assume dB/dt=0 in **a stationary economy**
  - 2) (G-T)/Y = -rb; define G/Y:=γ and T/Y:=τ
  - 3) (τ-γ)/r = b; intertemporal budget constraint is fulfilled since the present value of all (primary) budget surplus ratios τ-γis equal to b; recall **present value of eternal €=** $1/(1+r) + 1/(1+r)^2$ etc. (for n periods; with n approaching infinity) = 1/r

A more realistic budget constraint and some problems with the minimum wage (parameterε>0)

- Let us consider production function (ß= 0.33)
- 1) $Y = K^{ß}(AL)^{1-ß}$; MPL is marginal product of labor L
- Profit maximization: MPL=total real wage w‘
- 2) $\partial Y/\partial L=(1-ß)K^{ß}A^{1-ß}L^{-ß} = w(1+\varepsilon\tau)$;w is net wage
- 3) $L^{d} = (w(1+\varepsilon\tau))^{-1/ß}\,(1-ß)^{-1/ß}\,K/A^{(1-ß)/ß}$
- Minimum wage which leads to wage subsidies/rise of τ which effects? Taking logs gives approximation (using ln(1-ß)≈-ß)
- 4) $\ln L^{d}=(-1/ß)(\ln w+\varepsilon\tau) +\ln K -((1-ß)/ß)\ln A+1$

Labor Demand Function in the Context of CES Function

- $Y = (\alpha' K^{-\rho+}(1-\alpha')(AL)^{-\rho})^{-\rho\,'/\rho}\rho' = 1$ linear homogenous
- Assume profit maximization which implies marginal product of labor = real wage rate
- Koyck adjustment process for optimal lnL:
  - $\ln L_t = \theta L^{opt}_t + (1-\theta)\ln L_{t-1}$; t is time index
  - Assume that $A(t) = A_0 e^{'at}$; $\ln A = \ln A_0 + at$
  - For **regression analysis** (with error term ε_t) we get
- $\ln L_t = \beta_0 + \beta_1 t + \beta_2(\ln(W/P)) + \beta_3 \ln Y_t + \beta_4 \ln L_{t-1} + \varepsilon_t$

Parameters to be considered (with ρ‘=1)

- β_0 cannot be identified (...)
- $\beta_1 = \lambda\rho a/(1+\rho)$
- $\beta_2 = \lambda/(1+\rho)$
- $\beta_3 = \lambda$
- $\beta 4 = 1-\lambda$.

Wage Subsidies and Minimum Wage (see France)

- **In France** firms employing minimum wage earners get a **subsidy of 26% of wage costs** = € 22 bill. = about 1% of GDP; creates deficit-GDP ratio of 1% and implies (with output growth rate of 1,5%) a **long run debt-GDP ratio** – only from this wage subsidy – of 66.7%.
- If one assumes an interest rate of 4% the implied **interest expenditure-GDP ratio is 2.7%**; the income tax rate would have to be raised accordingly (at least partly; parameter ε). With ß=0.33 employment is reduced by 8% (-4% realistic?);
  - you could roughly cut the long run unemployment rate by 50% if you could do away with wage subsidies! **Paradox!**

Deficit policy/debt policy of governments

- 1) discretion of central government – possibly good for **stabilization policy** – and balanced budget requirements in 49 US states (requirement in most state constitutions in the US)
- 2) **debt brake rules** (rainy day fund) as first established in the region of St. Gallen (1929)
- 3) **Maastricht Treaty of the EU**: euro area countries (started in 1999 with 11 countries) should have maximum of 3% deficit-GDP ratio – and balanced budget in medium term - and maximum of 60% debt-GDP ratio; Treaty did not work...euro crisis

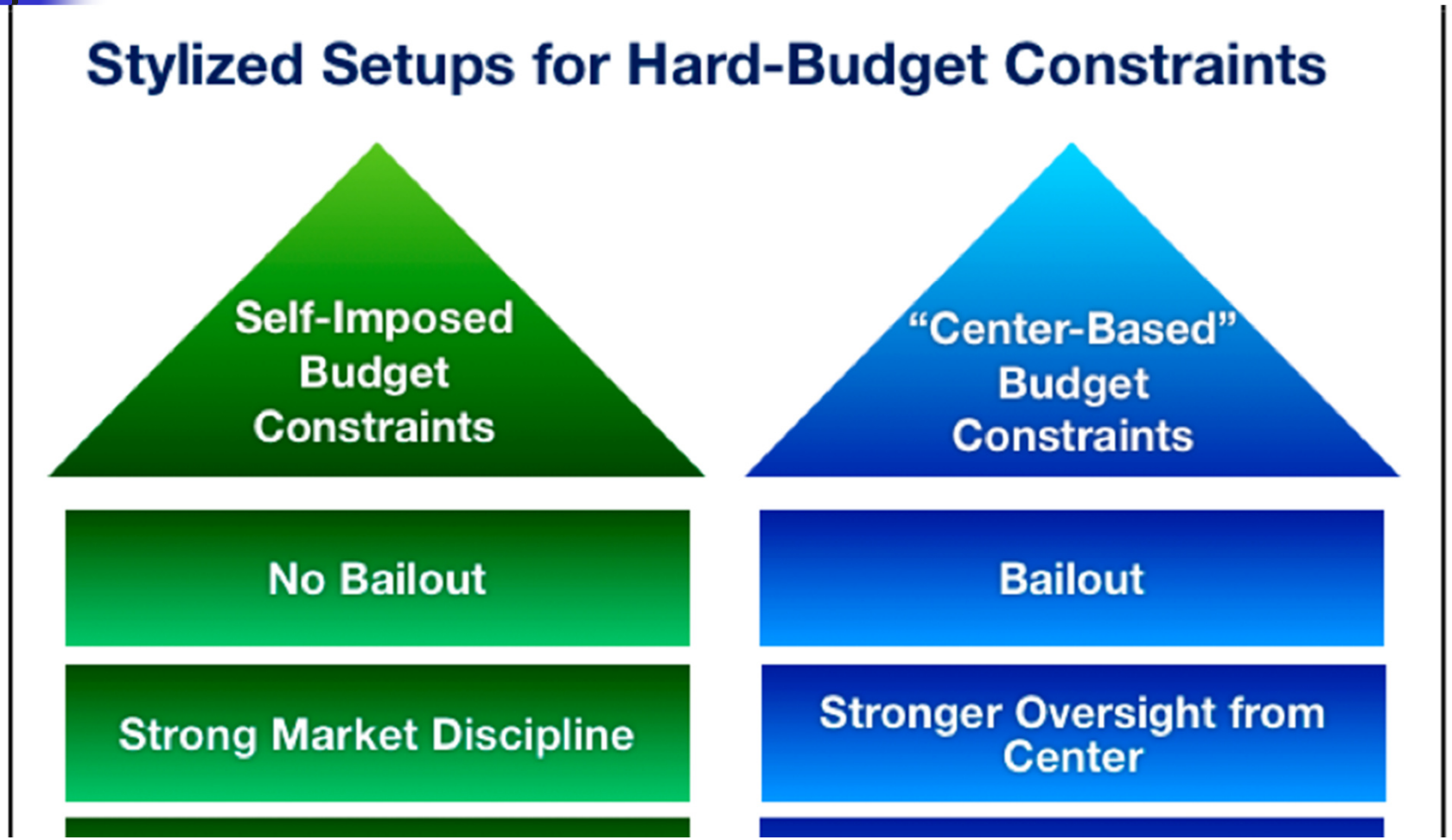
Which deficit rules work?(on 2)-4) see Jeffrey Frankel, 2005

- 1) Constitutional deficit rules/debt brakes: **YES**
- 2) Starve the beast (US Republicans in first Reagan Administration Term and Bush Sen. Term): „cut taxes and spend", the rising deficit will force government to cut spendings! NO
- 3) Rigid rules (e.g. balanced budget rule): NO, as this does not allow anti-cyclical policy
- 4) „Shared Sacrifice" (1990s, Clinton Admin.): Flexibility but useful rules and package deal: **YES**

Shared Sacrifice Fiscal Regime has three elements („I will agree to forego my tax cuts if you forego to raise expenditures")

- 1) government puts growth caps on discretionary expenditures
- 2) **Paygo-rule:** members of parliament that suggest tax cut or rise of expenditure have to indicate how this is to be financed
- 3) **preserving the new on-budget surplus** under the slogan: Saving social security first
  - Jeffrey Frankel (2005), Comment, in: POSEN, A.S., ed., The Euro at Five: Ready for a Global Role?, Washington DC, 157-169

Two different regimes: central government, regional gov. (IMF, 2013)



Why are periods of debt crises so dangerous?

- 1) Risk of sudden stop:no more capital inflows, rapidly rising capital outflows; massive depreciation, rise of r!
- 2) If refinancing government debt is no longer possible there will be **debt restructuring** or default of country = confidence problem; **rating at C/D**
- 3) If government debt mainly is *foreign indebtness* the current account can no longer be in deficit; now a CA surplus must be achieved – a) reducing absorption real C+I+g; b) improving competitiveness; for a) see

Y – (C+I+G) =Xnet; C=C(Y,T); I=I(r,T‟); T tax rev.

Improving CA: Expenditure Reducing, Expenditure Switching

- Consider the tradables sector (T) and the **non-tradables sector (N)** in a **small open economy**
  - T-sector surplus = trade surplus (current account surplus)
  - **T/N mix:** relative price of N-goods to T-goods should fall = production of N-goods falls; with given aggregate K and L the consequence is a rise of T-production so that current account will improve (N-sector price is partly determined by **public sector wages** – often rather high: Spain, Portugal, Greece in euro crisis), lack of competition in N sector; hence more active **competition policy**, deregulation etc.
  - Formal analysis is given by MUNDELL (Monetary Theory, chapter 9)

3 Questions

- 1) What happens with growth rate of knowledge (progress rate) if G= G‘+G“ where G‘ is government consumption and G“ is promotion of research and development? (Welfens, 2011)
- 2) Are Government Bonds Net Wealth? Question of David Ricardo: Rise of B implies rise of future taxes; bonds are no net wealth..., but what should we think about the „consumer surplus+producer surplus“; long term government bond raising time horizon (?)
- 3) How to tame the problem of excessive debt?

Solow Growth Model, K capital, L labor; t is time, δdepreciation rate, n growth rate of L

- 0<ß<1; production function **1) $Y=K^{ß}L^{(1-ß)}$**

1') $y:=Y/L = k^{ß}$ where capital intensity k:=K/L

- Savings function 2) S=sY; hence S/L = sy (y:=Y/L)
- Goods market equilibrium condition is **S= gross investment dK/dt +δK:**
- 3) (dK/dt + δK)/L = sY/L; recall that dk/dt = (dK/dt)/L – nk where n is the growth rate of labor, namely (dL/dt)/L; **insert 1') in 3):**
- 4) $dk/dt=sk^{ß} –(n+δ)k$; 5) $k\#=(s/(n+δ))^{1/(1-ß)}$ from dk/dt=0; hence $y\#=(s/(n+δ))^{ß/(1-ß)}$

Conclusion for Long Run Y# in this Supply-Side Full Employment Approach

- $y\#=(s/(n+\delta))^{\beta/(1-\beta)}$
  - Recall that $y= Y/L$; $L(t)= L_0 e^{\lambda nt}$; L_0 is initial level of labor (size of population)
- $Y\# = (s/(n+\delta))^{\beta/(1-\beta)} L_0 e^{\lambda nt}$
- What if the population is constant (**n=0**)?
  - $Y\# = (s/\delta))^{\beta/(1-\beta)} L_0$
  - The long run real equilibrium output is determined by the savings rate and the capital depreciation rate; and given L.
  - The higher the savings rate the higher the long run output

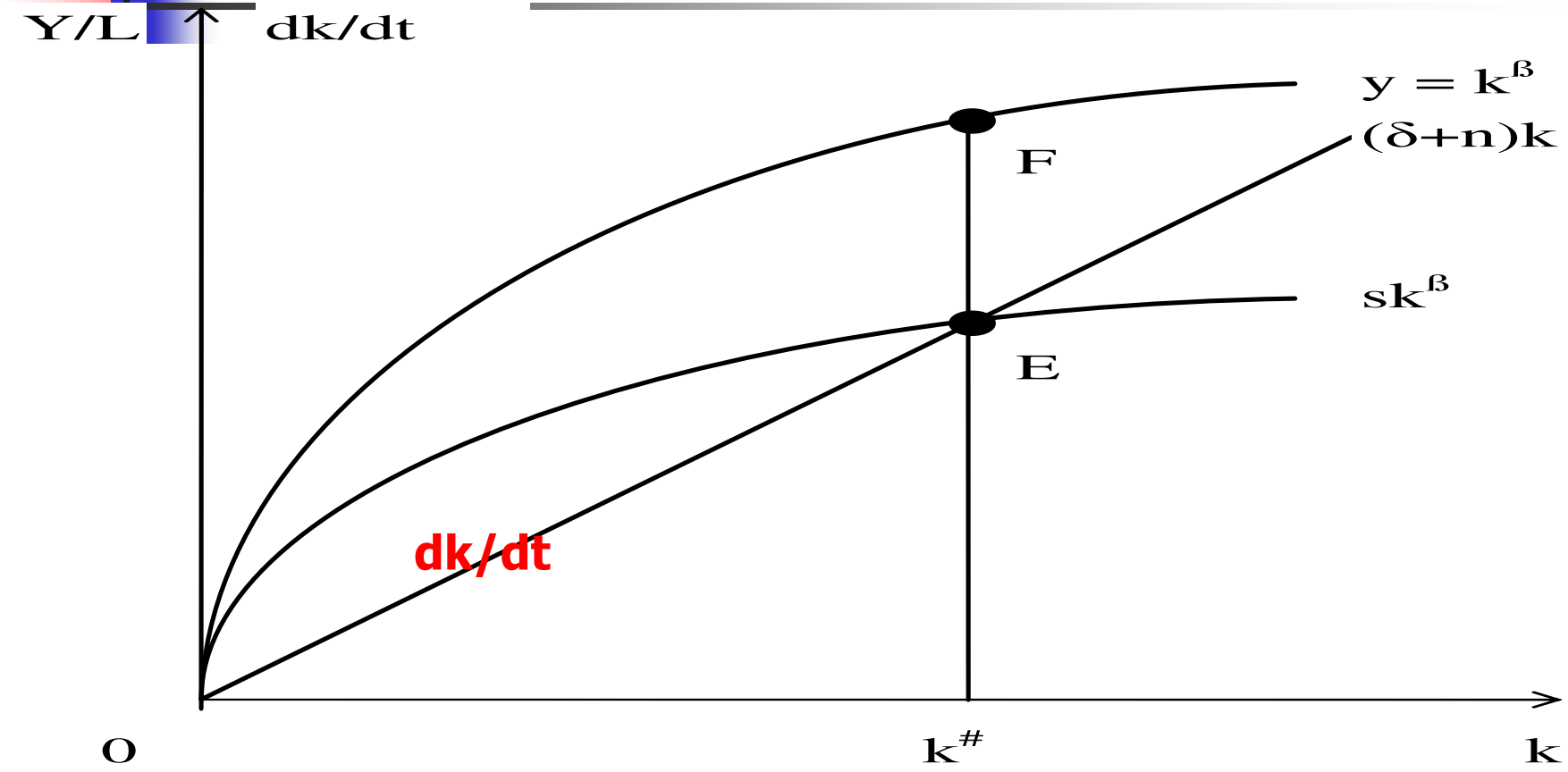
Long Run: Modified Neoclassical Growth Model (m is positive external production effect of households holding m: Welfens, 2011)

- (3) $Y= (M/P)^{\beta'}K^{\beta}(AL)^{1-\beta}$; (4) $y'= m'^{\beta'}k'^{\beta}$; $y':=Y/(AL)$ growth rate of knowledge a; growth rate of L is n, e' Euler number,$m:= m'/(AL)$, $k':=K/(AL)$; $I^{gross}=dK/dt+\delta K$
- Savings function (5) $S=s(1-\tau)Y$; *note $0<\beta'<1$*
- Equilibrium condition for goods market is here (6) $S/(AL)= I^{gross}/(AL)$; AL is labor in efficiency units; (7) $dk'/dt = (dK/dt)/(AL) - (a+n)k'$ according to differentiaton rule; (4), (5), (6), (7), **$dk'/dt=0$** gives steady state **#**
- (3) **$Y\# = e^{'(a+n)t}\, m^{\beta'\beta\beta'/(1-\beta)} A_0L_0 (s(1-\tau)/(a+n+\delta))^{\beta/(1-\beta)}$**

$$Y\# = e^{\lambda(a+n)t} m^{\beta\lambda\beta\lambda/(1-\beta)} A_0 L_0 (s(1-\tau)/(a+n+\delta))^{\beta/(1-\beta)}$$

- Growth rate of output in the long run (steady state) is given by **a+n**; to compare this growth – supply-side – approach with Keynesian approach one may set a=0, n=0; thus we get the **level of the growth path**
- The long run (steady state) equilibrium output Y# is
  - a **positive function of the real money stock** (we have assumed zero inflation; inflation creates problems – e.g. instead of ß we have ß"=ß - v"π; the parameter v" is positive (but leaving ß">0))
  - The **level of the growth path** is the higher **the higher s!**

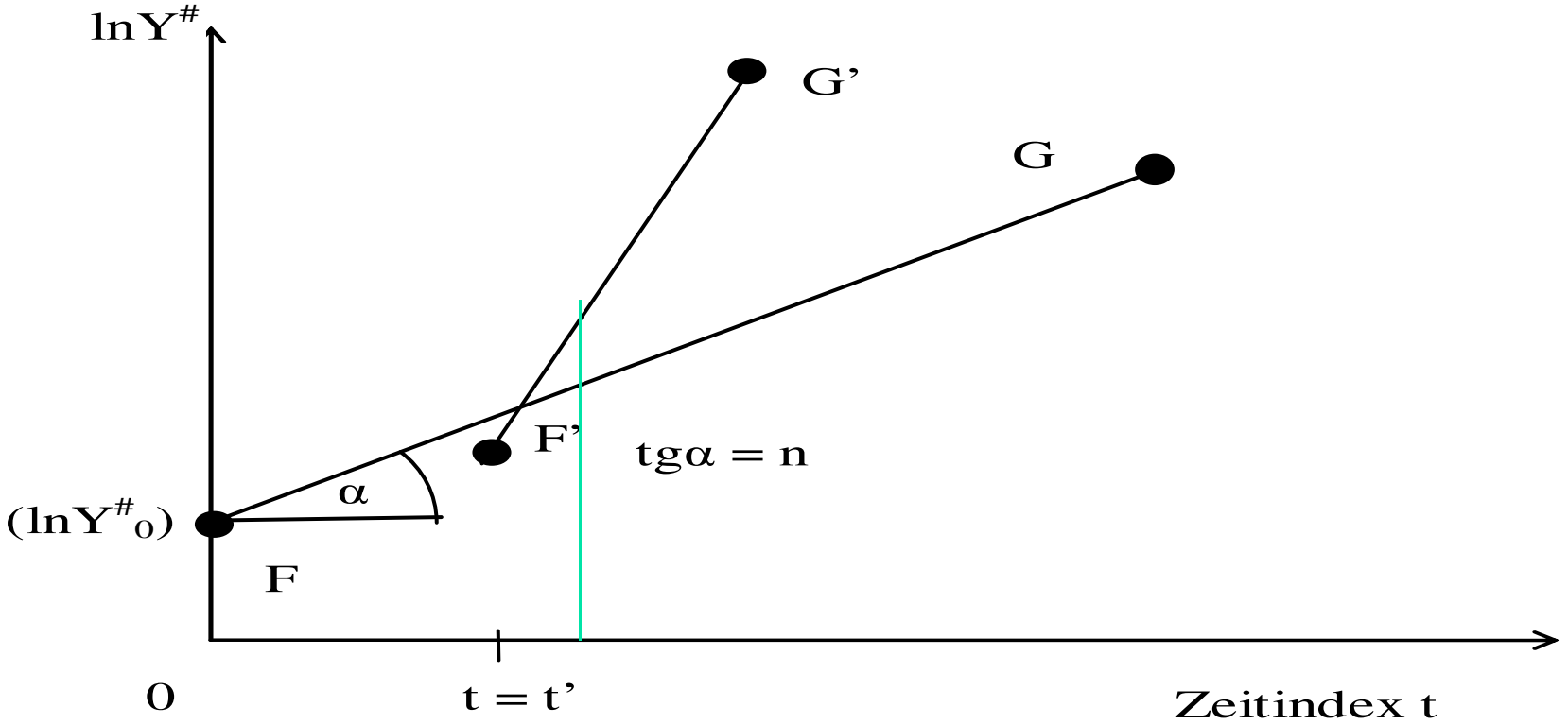
Graphical Solution (with τ=0); distance EF=C/L; **golden rule** C/L is maximized (Phelps, v. Weizsäcker, 1966; y:=Y/L)



Note: difference between y and per capita investment ((δ+n)k)= C/L; MAX C/L Gives (ßY/K - δ)=n; or **golden rule** r=n! (n is growth rate of pop. and of output in steady state!); Piketty r>n!!

Level of Growth Path (point F) and Growth Rate (tang α)

Effect of an Increase in Population Growth Rate n (in t')



Current Account Balance

- **Merchandise Trade Balance** plus **Services Balance** plus capital balance (workers‘ remittances and unilateral transfers) = Current Account Balance
- If CA is negative there is rising foreign indebtedness – what is the limit(?); the rating position of the country: as long as A or B+ this is ok, below there is a problem as default probability of country seems to be high...

The Current Account X‘ Is Explained by...

- X‘ = (Y – Y“) – (I – I“) – (G –G“)
  - Consumption smoothening (Obstfeld/Rogoff. Ch2); If Y exceeds its **permanent level Y“**, exports rise; rather than increasing C households choose to accumulate foreign bonds (assets) as a natural way of smoothening planned consumption over the future. If investment exceeds I“ households borrow from abroad in order to finance extra investment instead of lowering C; also if G>G“
- Y – (C(...)+I(...)+G) = X‘
  - Here net exports/current account explained by domestic absorption (C+I+G); with production Y given

Fixed Exchange Rate vs. Flexible Exchange Rate

- Flexible exchange rate imply that current account deficit (if there is any) has been financed by net capital inflows – the latter amount to supply for foreign exchange; current account deficit implies a demand for foreign exchange: FOREX market always is in equilibrium, but sudden changes of e can have effects. E.g. a (strong) devaluation raises the real value of external indebtedness, expressed in domestic currency units.

Central Banks (SDR = special drawing rights of the IMF)

- A) conducting monetary policy – autonomy only in system of flexible exchange rate
- B) sometimes responsible for prudential supervision (US FED, Bank of England, ECB since 2014)
- C) holding foreign reserves = short term bonds (+gold) = getting low interest payment; reserves will depreciate in domestic currency units if there is nominal appreciation of domestic currency; SDR (see IMF...)

Demand vs. Supply Approaches; small vs. large

- 1) **Keynesian** demand approach
- 2) **Supply-driven** approach = growth model
  - Traditional neoclassical model vs. endogenous growth model (explaining technological progress)
- 3) ***Small Open Economy perspective*** vs. **Large Country** (2 country model)
  - Small country: all international prices given
  - Large countries: country I – economic policy (e.g. expansionary fiscal policy) affects country II; followed by repercussion effect on country I (e.g. US and Euro Area policy)

Aggregate Demand Perspective: Mundell Fleming Model (i is nominal interest rate)

- (1) Y = c(1-τ)Y+ G – br + X - q*J; goods market equ.
  - C=c(1-τ)Y; τis income tax rate; investment I= -br (r is real interest rate), parameter b>0, G govern-ment consumption, Y is real gross domestic product
  - exports X= xY*q*; J= jY/q* as simple specification
- (2) money market equilibrium M/P= hY – h‘r; positive parameters h, h‘; M nominal money supply; P is the output price level (i=r!!)
- (3) v(r-r*) =jY – xY*q* (foreign exchange market equilibrium)

New Keynesian Econonomics

- Key elements
  - Monopolistic competition = market power= mark-up pricing P=(W/(Y/L))(1+ϕ); W/(Y/L) is unit labor cost; ϕ mark-up which is a cyclical variable
  - **Rational expectations (John Muth)** = forward-looking behavior
  - Market imperfections = wage and price stickiness
  - Matching frictions in labor markets
  - Moral hazard in labor markets
  - System is no guarantee for full employment
  - Possible multiple equilibriums

Simple New Keynesian Models in a Stochastic Context (stochastic disturbance terms u", v"); rational expectations

- (1) $Y^d_t = G''_t + b(m''_t - p_t) + u''_t$; (m" is lnM, p is lnP)
- (2) $Y^s_t = Y\# + h(p_t - p'_t) + v''_t$; b and h positive parameters

- (3) $Y_t = G''_t + b(m''_t - p_t) + u''_t$
- (4) $Y_t = Y\# + h(p_t - p'_t) + v''_t$
- **Apply expectation operator E:** (5) $Y^E_t = G''^E_t + b(m''^E_t - p'_t)$
- (6) $Y^E_t = Y\#$
- p' is expected price level: (7) $p'_t = m''^E_t - (Y\# - G''^E_t)/b$
- (8) $Y_t - Y^E_t = (G''_t - G''^E_t) + b(m''_t - m''^E_t) - b(p_t - p'_t) + u''_t$
- (9) $Y_t - Y^E_t = h(p_t - p'_t) + v''_t$

The Non-neutrality of Economic Policy in a Consistent New Keynesian Models

- (8) $Y_t - Y^E_t = (G''_t - G''^E_t) + b(m''_t - m''^E_t) - b(p_t - p'_t) + u''_t$
- (9) $Y_t - Y^E_t = h(p_t - p'_t) + v''_t$

- **(10) $p_t = p'_t + [1/(b + h)] [(G''_t - G''^E_t) + b (m''_t - m''^E_t) + u''_t - v''_t]$; b and h parameters**

- **(11) $Y_t = Y\# + [h/(b + h)] [(G''_t - G''^E_t) + b(m''_t - m''^E_t) + u''_t + b/h\ v''_t]$**

Some Leading Scholars of NKE

- Mankiw & Romer: book New Keynesian Economics, Vol. 1, 2; (micro foundations, 1991)
- Michael Woodford: **Interest and Prices: Foundations of a Theory of Monetary Policy**
- Goodfriend, Gali, Blanchard, Kiyotaki

NKE DSGE Models

- **Dynamic stochastic equilibrium models** (with rational expectations)
  - Goods market and labor market etc. considered in a stochastic context;
  - Raondom shocks: White noise error term (e.g. η) in each equation: expectation value E(η) is zero, finite variance σ
  - Monopolistic firms face price stickiness;
  - Output is a function of household‘s real demand which is partly determined by (monopolistic) price level
  - interaction of housholds, firms, gov., central bank; „Special technique“ to solve models with rational expectations

DSGE Models (continued)

- Dynamic model which shows how the economy system is developping over time
- Stochastic quasi-Walrasian system
- Households:
  - Maximize utility function (consumption, leisure)
- Firms
  - Profit maximization
- Government: Budget constraint (aim: e.g. full employment, welfare maximization?); central bank: low inflation rate (price stability)

Competing Schools of DSGE Modelling

Approaches:

- **Real business cycle (RBC)** model is based on neoclassical growth model in a setting with flexible prices: Real shocks to the system can cause business cycle fluctuations (KYDLAND/PRESCOTT, 1982; GOODFRIEND/KING, 1997); NO money!
- New-Keynesian DSGE based on a structure which is similar to RBC but here prices set in a system of monopolistic competition and adjustment costs (ROTEMBERG/WOODFORD, 1997; GOODFRIEND/KING, 1997; CLARIDA/GALI/GERTLER, 1999; GALI, 2008)

Read the following papers

- Goodfriend, M.; King, R. (1997), The New Neoclassical Synthesis and the Role of Monetary Policy, NBER Macroeconomics Annual 1997, Vol. 12, p. 231 -296.
- Clarida, R.; Gali, J.; Gertler, M. (1999), The Science of Monetary Policy: A New Keynesian Perspective, Journal of Economic Literature, Vol. 37, 1661-1707.
- Sbordone, A.; Tambalotti, A.; Rao, K.; Walsh K. (2010), Policy analysis using DSGE models: an introduction, Federal Reserve of New York Economic Policy Review 16 (2)
- Paper by STIGLITZ

Critique on DSGE

- Wllem Buiter: DSGE models are unable to catch the largely non-linear economic dynamics
- Counter-argument/Woodword: DSGE is evolutionary development along Keynesian macro modeling…
- Kocherlakota (FED of Minneapolis): argues that DSGE models not useful for analyzing the financial crisis of 2007-2010
- US Congress hosted hearings on macroeconomic modeling approaches (July 20, 2010) to understand why financial crisis 07/08 not foreseen: Solow critique (assumptions: DSGE presents economy like a „machine“) ; V.V. Chari defends DSGE: heterogenous actors are considered

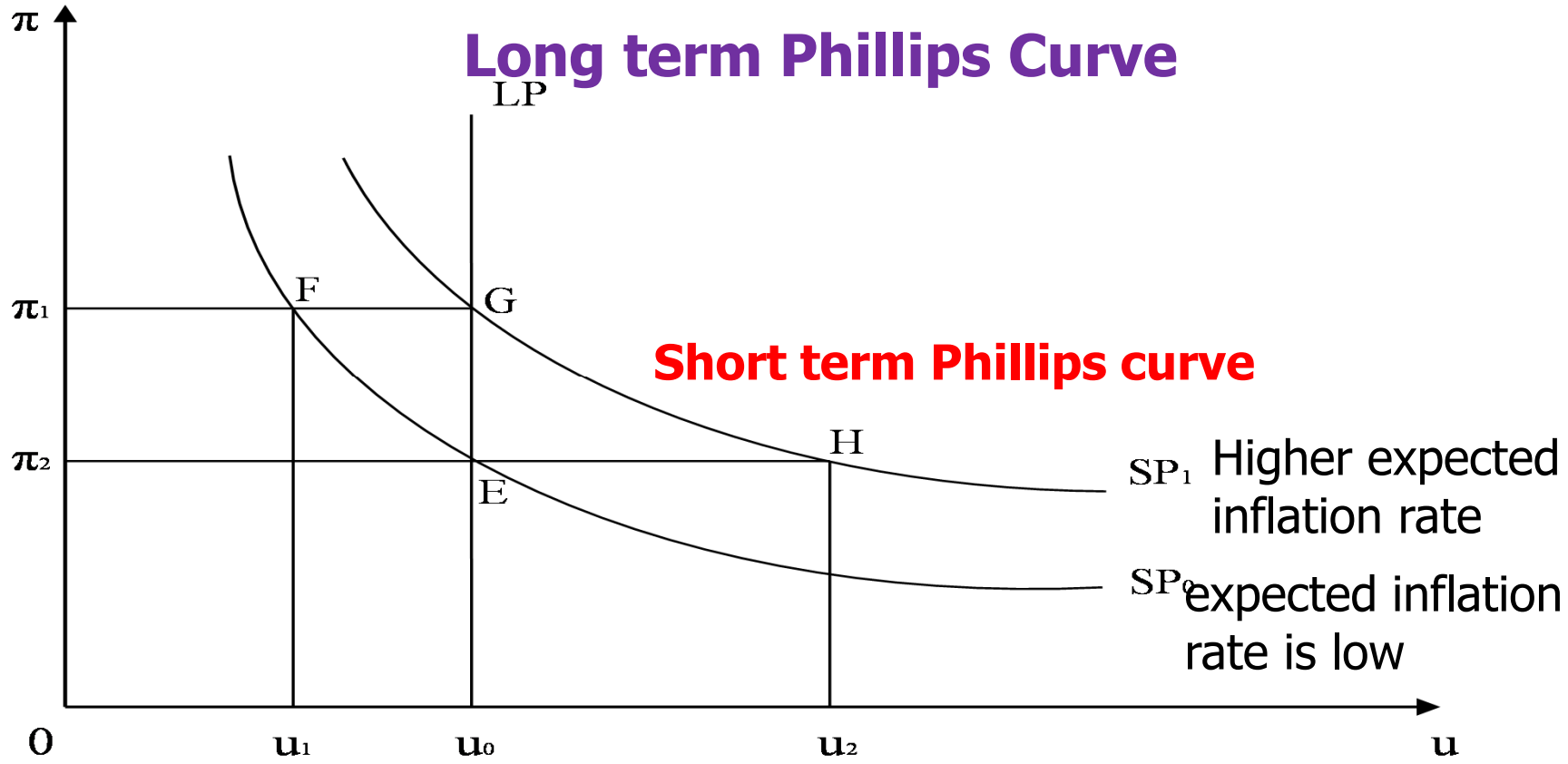
Some Criticism (Welfens, 2012a, Welfens 2011: Innovations in Macroeconomics, 3rd edition)

- Moral hazard in capital markets/the banking system!
- Hybrid consumption function is more realistic (microfoundation can always be found if empirical finding for hybrid function ok; Welfens 2011)
- Investment function is not consistent with steady state: proposed solution see Welfens (2012a)
- Implausible that households behavior etc. is not affected by the size of the variance of disturbance terms (e.g. in the goods market; see Welfens 2012a and the following reflections)

Modern NKE Models: Rational Expectations and New Keynesian Economics (e.g. GOODFRIEND)

- **Rational expectations revolution (MUTH):**
  - Economic agents are forward-looking
  - Expectation formation based on a model of the economy = rational expectations
  - There are, however, random shocks so that people cannot adjust in a perfect manner; but people have „on average" expectations which are correct.
  - Debate on Phillips curve looks different under rational expectations than under adaptive expectations: No short-term trade off that can be exploited by policymakers (here: central bank)

Short-term and Long-run Phillips Curve



Simple theoretical perspective: V is velocity, Y is real GDP

- **Quantity equation M V = P Y**
- $g_P = g_M - g_Y$ (assuming V is constant; g is growth rate); central bank can raise the growth rate of stock of money (M); could be M1 (cash+time deposits) or M3
- If $Y=K^{\beta}(AL)^{(1-\beta)}$;
  - $g_Y = \beta g_K + (1-\beta)(a+n)$;

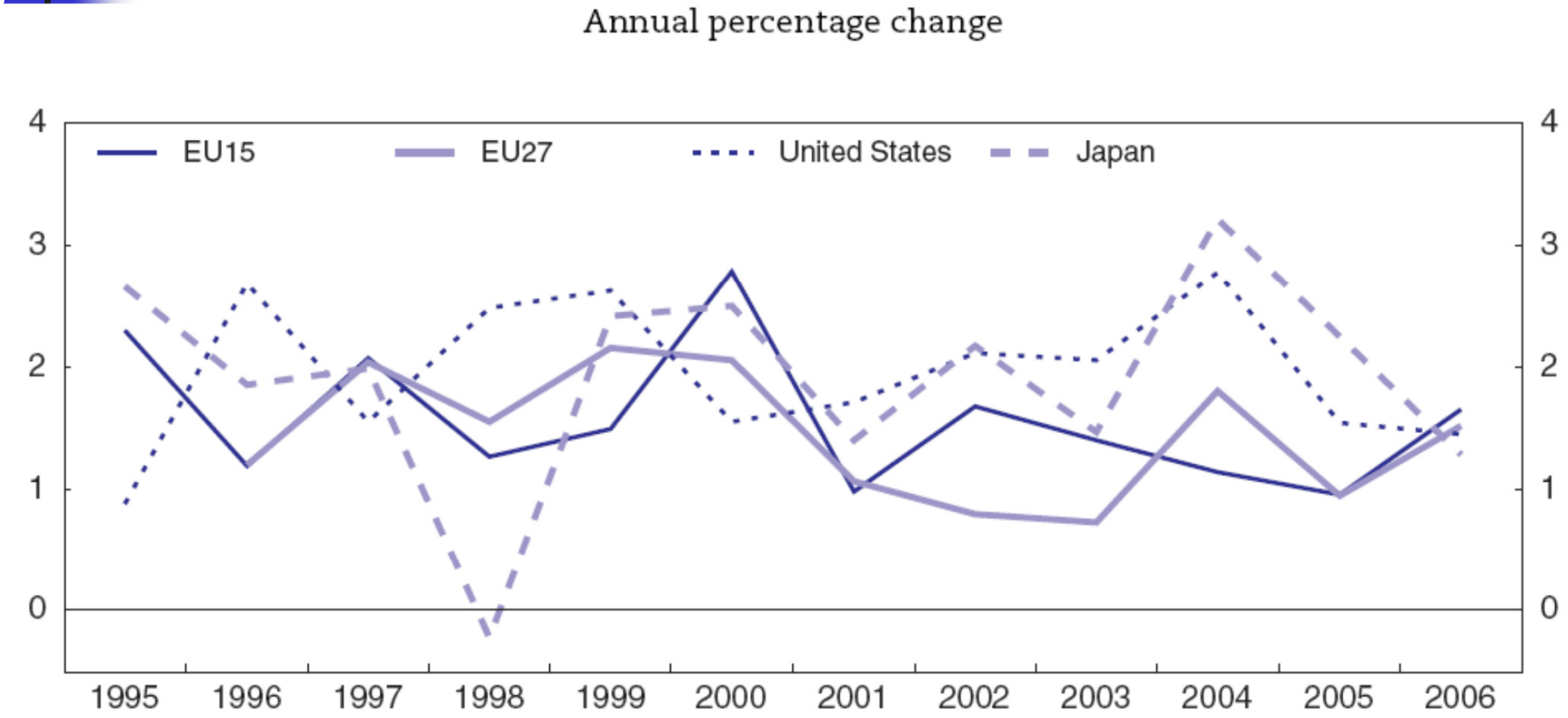
New Keynesian Models

- There are rigidities in labor markets or goods markets (realistic adjustment costs)
- People: rational expectations about inflation rate; expectations also relevant for other variables. *Unclear with respect to gov. Debt (see the debt crisis in OECD countries 2010/11)*
- Households maximize utility of consumption within a model of intertemporal optimization:
  - Infinitely lived households with time preference ρ
  - Ricardian households (Ricardo equivalence theorem)

Some critical remarks

- Banking crisis 2007/08 almost deadly for US system and UK system and euro system
- Unstable banking system? Why? Strange incentives (change in investment banking in US, financial innovations – see RAJAN paper) and insufficient regulation, naive prudential supervision. Big banks were bailed out, too big to fail-problem
- Inadequate innovation system in banking(Welfens, 2011); ***much fraud in big banks – e.g. fixing interest rates, exchange rates, bad advice to clients; not in our MACRO MODELS as problems***

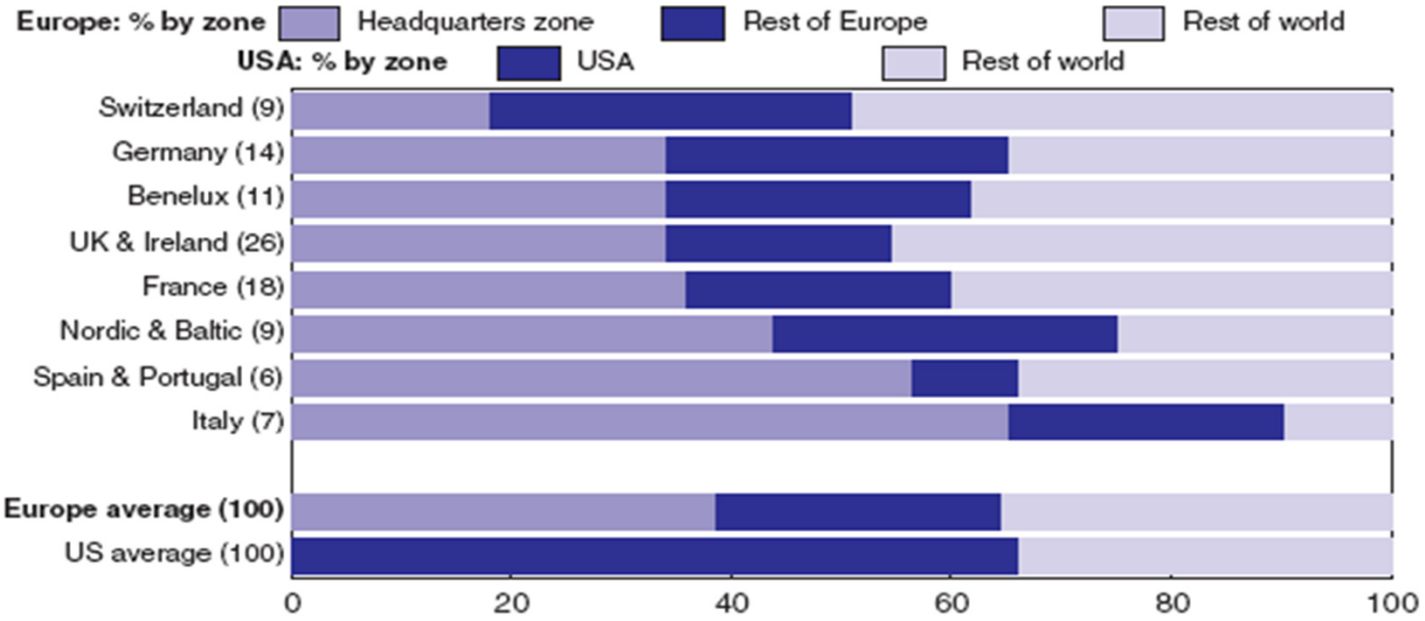
Productivity[1] Growth



1. GDP per employee for the EU27 and GDP per hour worked for the others.

Source: Eurostat and OECD, *Economic Outlook No. 81 Database*.

Europe Top 100: Average revenue structure



Source: Véron, N. (2006), "Farewell National Champions", *Bruegel Policy Brief*, Issue 2006/04, June, Figure 4.

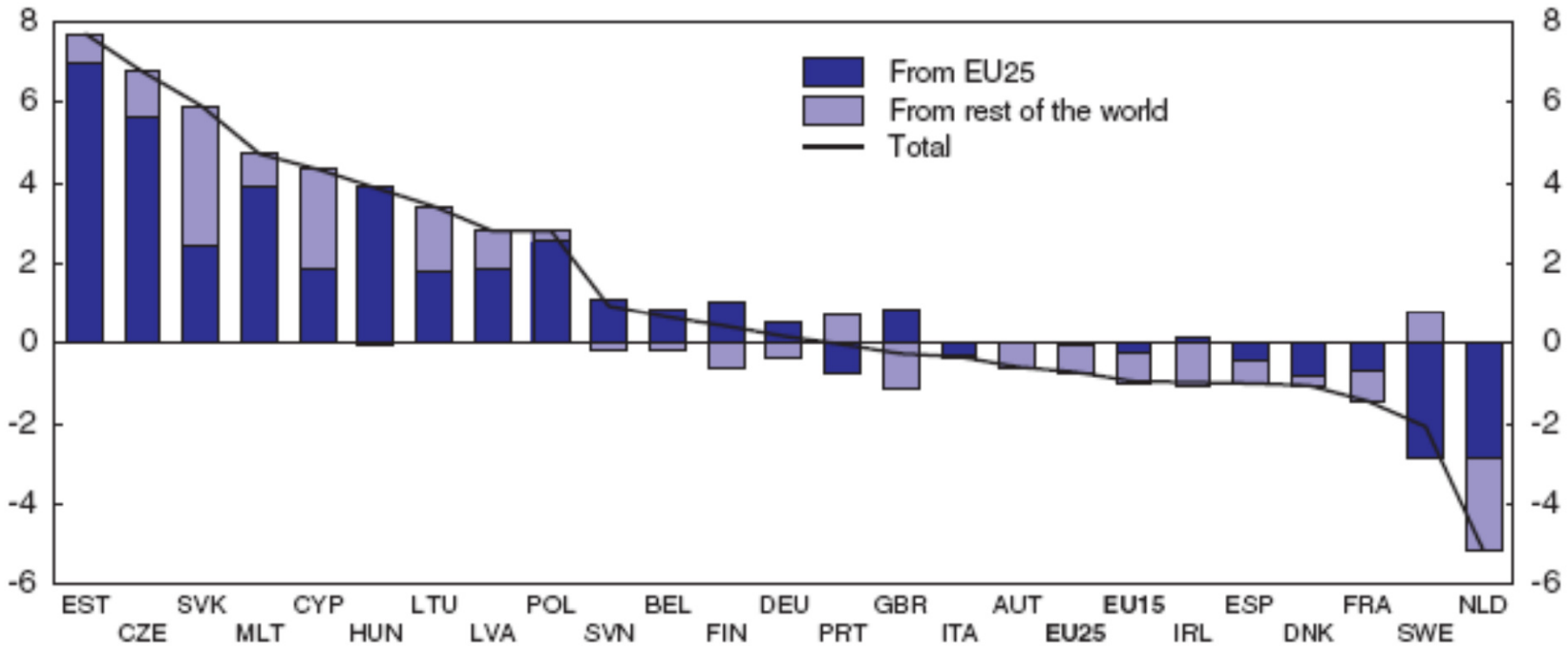
Export shares by skill intensity (2004)

	High technology	ICT (part of high-tech)	Medium-high technology	Medium-low technology	Low technology
World	**23.5**	**15.4**	**41.3**	**14.1**	**21.1**
EU15	22.8	9.8	46.9	12.7	17.6
EU12	14.1	13.9	41.3	18.5	26.1
US	32.8	17.5	43.6	9.7	13.9
Japan	23.8	18.4	59.9	12.1	4.2
China	27.7	24.9	27.7	12.8	31.8
SE Asia (excluding China)	36.9	32.5	32.4	9.3	21.4

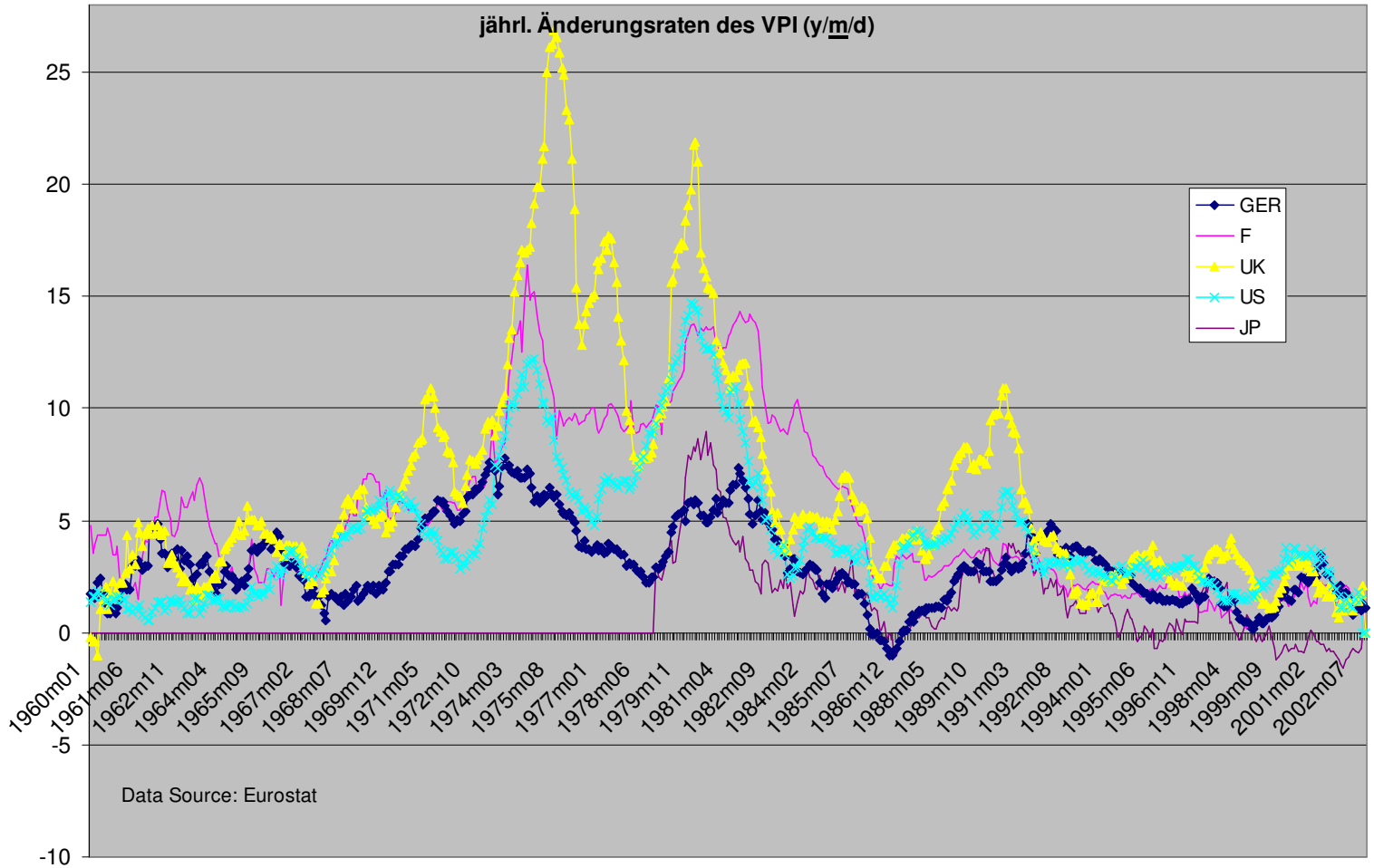
Source: OECD calculations based on UN Comtrade.

Net FDI inflows

In per cent of GDP, 2001-05



Source: Eurostat.


jährl. Änderungsraten des VPI (y/m/d)
25
20
15
10
5
0
-5
-10
1960m01
1961m06
1962m11
1964m04
1965m09
1967m02
1968m07
1969m12
1971m05
1972m10
1974m03
1975m08
1977m01
1978m06
1979m11
1981m04
1982m09
1984m02
1985m07
1986m12
1988m05
1989m10
1991m03
1992m08
1994m01
1995m06
1996m11
1998m04
1999m09
2001m02
2002m07
GER
F
UK
US
JP
Data Source: Eurostat

Thank you for your attention

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