Endogenous Growth

↳ does not cover creation of technology explicitly

[3] not elegant, not data-driven

[4] take neo production function and add another part that contains t
[5] ↳ firms treat $A(t)$ as a constant, don't internalize it

[13] $a_3 = 0$ since $(1-\alpha)$ always greater than zero
↳ we can only use this way of reasoning when appealing to the transversality condition

[12] important part of every transversality cond.: $e^{-(\rho-n)t}$ → goes to 0 as time goes to infinity
↳ discounting factor (for shadow price of additional unit of savings)

[14] $c(t)$ and $u(t)$ grow at the same rate $e^{\frac{\alpha-\delta-\rho}{\theta}}$

[15] problem with endogenous growth models: imply much larger development differences than empirically observed (also 1.6 → exponential function with $\frac{\gamma}{\theta} > 1$)
↳ explanation for diverging economies + convergence

[17] externalities from government expenditure → analytically similar to Romer
↳ household does not know how it is affected by gov exp.

[19] taxation not wasteful since proceeds are spent from government and can be seen as production factor

[20] trade-off between lower net return and higher government expenditure in $\frac{\dot{c}(t)}{c(t)}$
↳ has some role for policy (as compared to Romer)

[21] optimal τ maximizes the growth rate

[24] no difference in planner and equilibrium rate

[26] population is constant at any point in time
↳ HC is the result of a trade-off between working and not working

[28] have two state variables (that's also why we had μ_k)
↳ also two transversality conditions

[32] u is always a value between 0 and 1

[34] $c(t)$ and $k(t)$ have to change at the same rate to preserve the value for $\frac{c(t)}{c(t)}$

[36] balanced growth → c and k grow at the rate of human capital
↳ even if you have no externalities, the growth rate is constant

[38] all of these are positive and constant

[40] better than others in a way that there is no need for parametric restrictions or externalities

[41] physical and human capital accumulation follow the same pattern

[42] model is used like a strict data generating process

[44/45] implied α, implied β is crucial

    ↳ omitting HC is obviously a mistake

    ↳ HC is very important

    ↳ the further you move towards development (developed?) countries the less "physical capital seems to matter

[48] cond. convergence for all countries

    ↳ uncond. only for OECD (which have very similar n, g, δ)

[50] for policy: why is investment/GDP ratio different for countries?

[53] technology generated by innovative ideas that are incentivised by monopoly rents

[55] Pareto distribution used for modeling unlikely events and income inequality

    (very few people earn a large share)

[59] Cobb-Douglas is the result of ideas drawn from a Pareto distribution put into a Leontief production function

    linearization as the engine to endogenous growth !

[65] in the aggregate, when everything is multiplied by A, we get increased returns

    shutdown condition for research if no profit could be made (but costs are incurred)

[66] integral the sum of all the machines

[67] innovation does only depend on the money spent, not on any workforce

    → technological progress truly endogenized

    → but inefficiency created via monopoly deadweight loss

[68] time-separable: problem is the same at every point in time

[70] price is constant over time and machines and it's greater than the MC

[72] increasing returns visible in the formula for $Y(t)$

    ↳ growth rate of output is determined by the growth rate of machines

[73] $X(t)$ is a static investment in physical capital; $Z(t)$ is investment in machines

[75] everyone can enter research (→ condition similar to competition)

[76] reason for portfolio: closed household + Euler equation possible

[77] value is profit divided by interest

[78] implies that economy grows at a constant rate

[80] no externality whatsoever → ideas are result of actual decision-making (not only HC is decided upon)

    [82] actual machine demand would be higher in the social planner case

[83] you cannot forbid monopoly rents

    ↳ either profit taxation or innovation subsidies

    ↳ monopoly rents are a necessary evil to generate technological progress

[84] different production function and law of motion are relevant

⑤ Unified Growth

→ economic growth is a fairly recent phenomenon; it's driven by certain regions while others lag behind

→ [13] preference for children has to be included

[15] P_d → population density

[17] steady state is just a number

    $p →$ children's costs   : decisive factor in current research to explain reproduction

[25] quantity-quality tradeoff in preferences for children

    → $h_g(.) < 0$ and $h_{gg}(.) > 0$ assumptions not necessarily needed

㉖ subsistence consumption to induce Malthusian behavior if $z_t \leq \tilde{z}$

    ↳ fertility behavior becomes non-Malthusian as soon as the economy is rich enough

[32-34] transition of regimes in terms of graphs

    ↳ from zero education to positive education