Post-Keynesian Growth Theory and the Supply Side

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Introduction

- PK macrodynamics renowned for models of demand-led growth
- BUT – canonical models little more than 'moving IS' relationship (or moving XM relationship in case of Kaldorian variants)

Introduction (cont.)

Two key criticisms:

- Kregel (1985) – 'Hamlet without the Prince': models real-side only
- Cornwall (1972) – 'Say's law in reverse' – supply side always fully and automatically accommodating of demand-led growth

Introduction (cont.)

- Premises of lecture:
  - 'Say's law in reverse' not always appropriate
  - Even when it is, attention to supply side can prove important
  - So either way, *supply side merits closer attention in demand-led growth theory*
- Original intention – 'laundry list' of topics that leaned towards issues of gender

Introduction (cont.)

- BUT – learning by doing!
- Result – new H_0: feminist-structuralist macro theory as a 'general framework' for integration of AD and AS in theory of long-run growth *and* furtherance of longstanding debate about influence of distribution on growth
- Purpose of lecture: motivate interest, rather than provide complete analyses of issues
  - 'focus on the forest rather than the trees'

Plan of lecture

- Where to begin?
  - ans: with supply-side detail that's already implicit in PK growth models
- Where to go next?
  - ans: avenues of research that usefully and more explicitly integrate supply-side considerations into demand-led models
  - in particular, three seemingly unrelated literatures that (*inter alia*):
    - point to possible reconciliation of AD and AS in theory of long-run growth ...
    - ... and provide new insights into relationship between distribution and growth
- Summary and conclusions
  - 'we all should be feminist-structuralist macro modellers now'

The Dame Julie Andrews principle

Let's start at the very beginning
A very good place to start

Dame Julie Andrews
(aided and abetted by Rodgers and Hammerstein)

- In this case, 'starting at the beginning' involves a brief review of *what's already present* (if only implictly) in demand-led growth models
  - theory of production
  - potential output growth
  - theories of technical change
    - Verdoorn law
    - induced, factor-biased technical change

Theory of production

$$Y_p = min\left[\frac{K}{v}, \frac{N_{max}}{a}\right]$$

where $N_{max} = (1 - U_{min})L$

- Choice of Leontieff technology no accident:
  - *realism* – rooted in observed history of technology (Rosenberg, 1976) ...
  - ... and as such, consistent with PK concerns with *historical vs. logical time* (Harris, 2022) (in this case, w.r.t. analysis of long-term growth and technical change)

Potential output growth

From production technology:

$$Y_p = \frac{K}{v}$$

$$Y_p = \frac{N_{max}}{a}$$

- Can be thought of in terms of distinction between Lewis-type and labour-constrained economy
- Latter characteristic of advanced capitalism (and will be focus here) (see also Skott (2020))

Potential output growth (cont.)

$$Y_p = \frac{N_{max}}{a} = \frac{(1 - U_{min})L}{P}\frac{P}{a}$$

where P denotes total population

$$\Rightarrow y_p = -\hat{a} + n = q + n$$

where $q = \hat{Q}$, $Q = \frac{1}{a}$, and labour force participation rate $(\frac{L}{P})$ assumed constant in long run

Potential output growth (cont.)

- Harrod's *natural rate of growth*
  - maximum rate of growth that can be achieved in the long run
- Growth ceiling, derived independently of (demand-determined) actual rate of growth

Technical change

Verdoorn law:

$$q = \alpha + \beta g$$

Induced, factor biased technical change:

$$q = \gamma \omega$$

- Link technical change to *growth* (g) and *distribution* (the wage share, ω), respectively

A menu of topics

Various issues merit exploration, including (but not limited to):

- Path-dependency and the supply side
- Reconciling AD and AS in demand-led growth theory
- 'Paying' for technical change
- Segmented labour markets: high- and low-skill workers; gender-based job segregation
- Human capital formation
- Social reproduction of the household
- Distribution and growth: the role of the supply side
  - capital widening versus capital deepening
  - distribution and potential output growth

Reconciling AD and AS in demand-led growth theory

E.g., Palley (2002); Dutt (2006a); Setterfield (2006)

Why bother?

$$y_p = q + n$$

$$g = g(Z)$$

Hence in general:

$$g = g(Z) \neq q + n = y_p$$

First Harrod Problem: equality of equilibrium and natural rates of growth possible, but not likely.

Reconciling AD and AS in demand-led growth theory (cont.)

So what?

First, note that:

$$Y = \frac{Y}{N} N$$

$$\Rightarrow g = q + e$$

$$\Rightarrow e = g(Z) - q$$

where e denotes the rate of growth of employment

Reconciling AD and AS in demand-led growth theory (cont.)

Now note that:

$$\eta = \frac{N}{L}$$

$$\Rightarrow \hat{\eta} = e - n$$

$$\Rightarrow e = n$$

in the steady state, because $0 \leq \eta \leq 1$.

Reconciling AD and AS in demand-led growth theory (cont.)

Hence upon substitution:

$$g(Z) - q = n$$

$$\Rightarrow g(Z) = q + n$$

$$\Rightarrow g = y_p$$

In short, steady state requires *absence* of First Harrod Problem

Reconciling AD and AS in demand-led growth theory (cont.)

Two solutions:

- Abandon steady state framework, or assume Lewis-type economy. BUT
  - second proposal already set aside
  - equilibrium method pervasive
- Seek reconciliation between g and y_p
  - preferrable in and of itself because of practical implication: constant rate of employment (in other words, forces recognition of labour constraint in advanced economies)

Reconciling AD and AS in demand-led growth theory (cont.)

Approach #1:

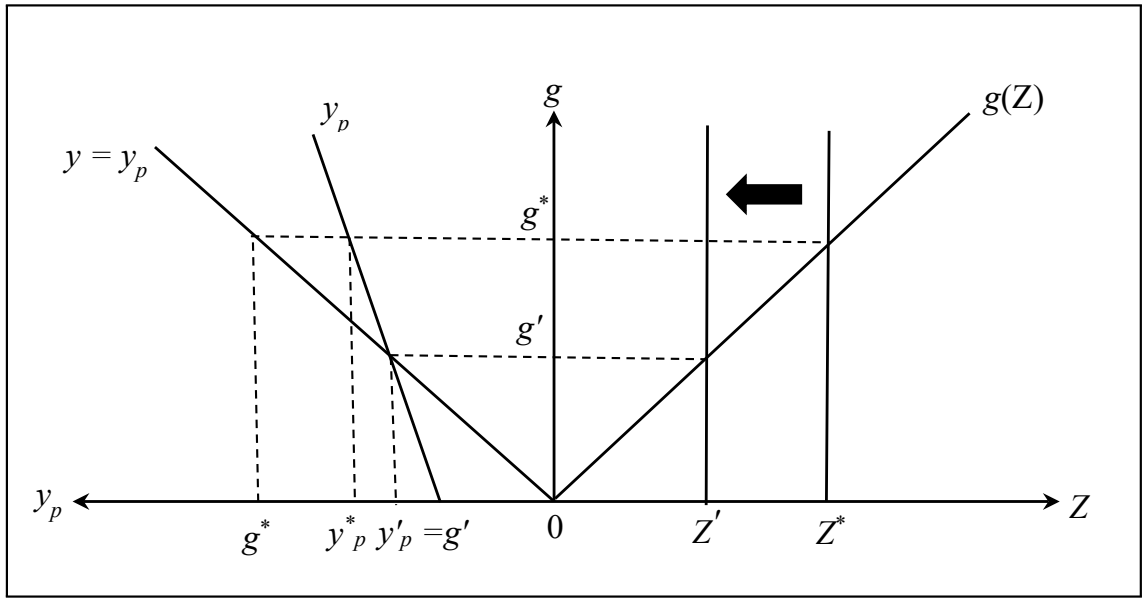
$$y_p = q + n$$

$$g = g(Z)$$

$$\dot{Z} = -\gamma(g - y_p)$$

Reconciling AD and AS in demand-led growth theory (cont.)

- $g > y_p \Rightarrow\downarrow Z \Rightarrow\downarrow g$ until $g = y_p$
- E.g., Palley (2002)
- *Supply-side 'rules the roost'*



Reconciling AD and AS in demand-led growth theory (cont.)

Approach #2:

$$y_p = q + n$$

$$g = g(Z)$$

$$\dot{q} = \delta(g - y_p)$$

$$\dot{n} = \phi(g - y_p)$$

Reconciling AD and AS in demand-led growth theory (cont.)

For example:

$$y_p = q + n$$

$$q = \alpha + \beta g$$

$$\beta = \beta(\eta) \quad , \quad \beta' > 0$$

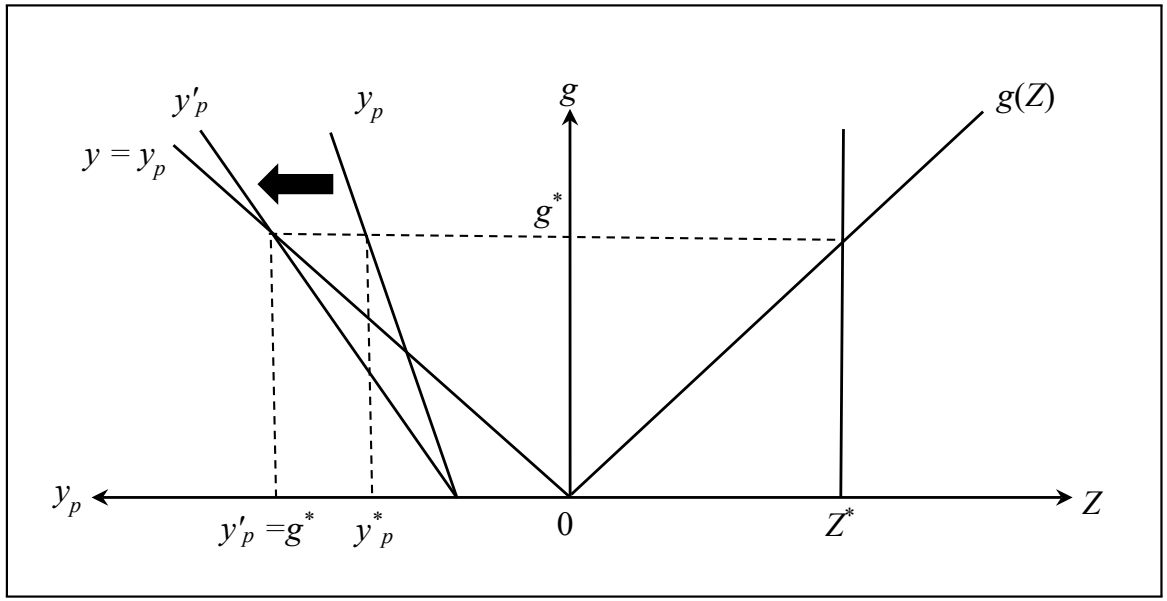
Reconciling AD and AS in demand-led growth theory (cont.)

Rationale: propensity of any given rate of growth to induce productivity-enhancing technical change depends on accompanying degree of macroeconomic 'slack'

- low η: $\uparrow g$ induces smaller $\uparrow q$ (low β)
- high η: $\uparrow g$ induces larger $\uparrow q$ (high β)
- Lamfalussy (1961, 1963) – 'defensive' (capacity maintaining) investment vs. 'enterprise' investment (R&D, 'Kaldorian' investment embodying technical change)

Reconciling AD and AS in demand-led growth theory (cont.)

- $g > y_p \Rightarrow \uparrow \eta \Rightarrow \uparrow \beta \Rightarrow \uparrow y_p|_{g=g^*}$ until $g = y_p$
- *Demand-side 'rules the roost'*



Reconciling AD and AS in demand-led growth theory (cont.)

- Adjustment mechanisms not mutually exclusive
- Empirics (focused on BPCG model) – Soukiazis et al. (2017); Cordeiro and Romero (2021); Ozcelik (2022)

Human capital formation

E.g., Lima et al. (2021); Serra (2021)

(See also Dutt and Veneziani (2018, 2020) for similar developments in classical-Marxian context)

In PK framework, investment in human capital constitutes both:

- An autonomous, non-*physcial*-capacity-creating expenditure; and
- A source of productive capacity on the supply-side (increases size of labour force in efficiency units)

Human capital formation (cont.)

Production function (after Lima et al. (2021); Serra (2021)):

$$Y_p = min\left[\frac{K}{v}, \frac{N_{max}}{(1-U_{min})}\frac{h}{a_H}\right]$$

where:

- $a_H = \frac{H}{Y}$ is the (constant) human capital (H) to output ratio
- $h = \frac{H}{L}$ denotes human capital per worker

Human capital formation (cont.)

Then:

$$Y_p = \frac{N_{max}}{(1 - U_{min})} \frac{h}{a_H} = \frac{(1 - U_{min})L}{(1 - U_{min})} \frac{h}{a_H} = \frac{Lh}{a_H}$$

$$\Rightarrow y_p = g_h + n$$

and since:

$$g_h = gH - n$$

then:

$$y_p = gH$$

Human capital formation (cont.)

Meanwhile, since:

$$g_H = \frac{\dot{H}}{H} - \frac{I_H}{H}$$

this brings us to investment in human capital (I_H) and hence to the *demand side*: who pays (and thus generates AD) and how?

Lima et al. (2021): I_H publicly funded by tax (τ)

$$I_H = \tau Y$$

$$\Rightarrow g_H = \frac{\tau Y}{H} = \frac{\tau}{a_H}$$

Human capital formation (cont.)

Serra (2021): I_H privately funded by household debt accumulation (after Dutt (2006b))

$$I_H = \theta \dot{D} + \mu\omega Y$$

$$\Rightarrow g_H = \theta \frac{\dot{D}}{K} \frac{K}{K_u} \frac{K_u}{Y} \frac{Y}{H} + \mu\omega \frac{Y}{H}$$

$$\Rightarrow g_H = \frac{\theta v}{a_H u} \frac{\dot{D}}{K} + \frac{\mu\omega}{a_H}$$

Human capital formation (cont.)

Meanwhile:

$$\dot{D} = \lambda(\omega Y - iD)$$

$$\Rightarrow \frac{\dot{D}}{K} = \lambda\left(\frac{\omega u}{v} - id\right)$$

Hence:

$$g_H = \frac{\theta v \lambda}{a_H u}\left(\frac{\omega u}{v} - id\right) + \frac{\mu\omega}{a_H}$$

$$\Rightarrow g_H = \frac{\omega}{a_H}(\theta\lambda + \mu) - \frac{\theta v \lambda}{a_H u} id$$

Human capital formation (cont.)

Demand-side differences matter:

- Lima et al. (2021):
  - human capital publicly funded by taxes (balanced budget); no public debt accumulation, but fiscal policy becomes policy concern
  - raising taxes to fund human capital accumulation has ambiguous effect on employment rate (supply of highly-educated workers does not create its own demand)
- Serra (2021):
  - human capital privately funded by workers borrowing from rentiers; household debt accumulation (financial fragility of household sector) becomes an issue, student debt relief becomes policy concern
  - student loan cancellation has only short-term macroeconomic effects; reducing loan interest rates has long-term effects

Human capital formation (cont.)

But in either case, we have both:

$$y_p = g_H$$

and :

$$g = g(g_H, Z)$$

Human capital accumulation contributes directly to demand-led actual rate of growth and potential rate of growth

Human capital formation (cont.)

Extensions (Serra, 2021):

- Segmented education market
  - 'high' and 'low' skill workers accumulating 'primary' and 'secondary' human capital
  - 'low' skill workers motivated (in part) by wage gap – accumulate human capital in effort to 'keep up with the high-skill Joneses'
- Reconciling AD and AS again
  - as noted, g_h contributes directly to both g and y_p
  - variation in g_H can therefore bring about reconciliation of g and y_p and so solve the First Harrod Problem

Social reproduction of the household

Some notes on terminology:

- Both market (e.g., day spa) and non-market (e.g., caring for sick relative) *care services* (Elson, 1995), plus human capital *narrowly defined* (as formal education and training), contribute to *human capacities*:
  - "features that make human beings more economically effective (such as emotional maturity, patience, self-confidence, and the ability to work well with others, as well as standard human capital measures such as skills and education)" (Braunstein et al., 2011, pp.9-10)
  - or simply "individual attributes that improve productive contributions" (Heintz and Folbre, 2022, p.150)

Social reproduction of the household (cont.)

- So defined, human capacities:
  - are acquired rather than innate;
  - are equivalent to human capital *broadly defined* (as as acquired attributes of individuals that enahnce their (marginal) productivity)
  - include *unpaid care in the home*, which is closely related to the Marxist-feminist notion of the *social reproduction of labour* (Folbre, 1994)
  - are accumulated through processes that are *gendered* (Braunstein et al., 2011, p.8)

Social reproduction of the household (cont.)

- Clear implications for demand formation – e.g., Seguino and Setterfield (2010)
  - composition of expenditures matters in BPCG framework
  - specifically, expenditures on domestically-produced services (for social reproduction) versus imported luxuries $\Rightarrow$ different income elasticities of M $\Rightarrow$ different rates of BPCG
  - result: distribution of income between men and women matters, given disproportional role of latter in social reproduction of household
- But what about demand *and* supply?
- Braunstein et al. (2011) (Kaleckian framework) to the rescue! (see also Braunstein et al. (2020, 2021) for empirical counterparts)

Social reproduction of the household (cont.)

Demand side – here, we encounter investment spending on marketed services that contribute to human capacities (H_c):

$$I = I_K + I_{H_c}$$

where:

$$I_{H_c} = I_{H_c}(o^e(\pi, u)) \quad , \quad I'_{H_c} > 0$$

and:

- o^e denotes expected opportunities, $o^e_\pi < 0, o^e_u > 0$
- *size* of I'_{H_c} depends on 'caring spirits'
- Caring spirits greater in altruistic than selfish societies
  - (key results emanate from this distinction – e.g., different effects of raising female wage in selfish vs altruistic society)

Social reproduction of the household (cont.)

Note that:

$$dI_{H_c} = I'_{H_c}(o^e_\pi d\pi + o^e_u du)$$

- Since $I'_{H_c} > 0, o^e_u > 0$ ...
- ... and *size* of I'_{H_c} depends on 'caring spirits' ...
- ... then *size of accelerator effect on total investment* in this model ($dI = I_{K_u} du + I'_{H_c} o^e_u du$) depends on caring spirits
- Importance: per Marglin and Bhaduri (1990); Bhaduri and Marglin (1990), size of accelerator effect influences character of demand regime (wage- versus profit-led)

Social reproduction of the household (cont.)

Supply side – here, we encounter unpaid care-giving (social reproduction of labour) in the household:

$$H_c = H_c(f(u), m(u))$$

where:

- $m' > f' > 0$: male wages (m) and female wages (f) increasing in u, but men have more bargaining power (gender segmentation of labour market)
- $H_{c_m} < H_{c_f} < 0$: unpaid care-giving decreasing in wages and to greater extent for men (gendered social reproduction of labour)

Social reproduction of the household (cont.)

Hence:

$$Q = \frac{1}{a} = Q[f(u), m(u), H_c(f(u), m(u))]$$

where:

- $Q_f, Q_m > 0$: classical induced, factor biased technical change
- $Q_{H_c} > 0$: productivity increasing in unpaid care-giving

Result: higher economic activity (u) and hence wages (f, m) has positive 'direct' effect and negative 'indirect' effect (via H_c) on Q.

Social reproduction of the household (cont.)

Note that H_c independent of I_{H_c}, because of short-run structure of model, and H_c modelled exclusively in terms of labour inputs. In other words:

- Unpaid care-giving affects H_c and hence Q, without generating demand for output
- Investment in marketed services that contribute to human capacities generates demand for output, without affecting H_c and hence Q
- In short: short-run structure means care-giving has demand- and supply-side effects that are independent of one another

Social reproduction of the household (cont.)

Also, no explicit production function, but this easy to remedy:

$$Y_p = min\left[\frac{K}{v}, N_{max}Q[f(u), m(u), H_c(f(u), m(u))]\right]$$

Then:

$$Y_p = N_{max}Q[f(u), m(u), H_c(f(u), m(u))]$$

$$\Rightarrow Y_p = (1 - U_{min})LQ[f(u), m(u), H_c(f(u), m(u))]$$

Social reproduction of the household (cont.)

But note this isn't the whole story:

- This is *effectively* a two-sector model, with the household sector producing a flow of non-market services that use labour and (arguably) marketed output as inputs
- This second production function not fully captured by the $H_c = H_c(.)$ function

Social reproduction of the household (cont.)

Moreover, and returning to expression for Y_p, expression for potential *rate of growth* more complicated:

$$y_p = q(.) + n$$

... but specification of $q(.)$ requires further thought:

- Derivation of $q(.)$ from $Q[.]$ function?
- Introduction of g_{H_c} as a result of I_{H_c} into $Q[.]$ and hence $q(.)$ (i.e., allow stock of human capacities to depend on flow of investment in human capacities in long run)
  - this problem 'solved' in neoclassical model of Heintz and Folbre (2022), but by treating H_c and g_{H_c} as exogenously given

Social reproduction of the household (cont.)

Nevertheless, there clearly is (or can be) *some* expression for q such that $q = q(g_{H_c})$, so that we can (or should eventually be able to) write:

$$y_p = q(g_{H_c}) + n$$

and (recalling structure of demand side):

$$g = g(g_{H_c}, Z)$$

Social reproduction of the household (cont.)

So that:

- Human capacity accumulation (including, but not limited to, the results of unpaid labour in the home) contributes directly to demand-led actual rate of growth and potential rate of growth ...
- ... and *a la* Serra (2021), variation in g_{H_c} may contribute to solving the First Harrod Problem

Social reproduction of the household (cont.)

Human capital and human capacities literatures: possibility for easy and/or fruitful cross-fertilization?

- How could there not be? As noted, broadly defined, human capital and human capacities are the same thing.
- But at present, there are subtle differences between these literatures, suggestive of 'gains from trade'

Social reproduction of the household (cont.)

For instance:

- Human capacities literature shows there's something broader than human capital narrowly defined, that includes whole new sphere of production (social reproduction in the household)
  - this also means that unlike human capital narrowly defined, the flow of human capacities is not fully accounted for as part of the single composite commodity Y
  - example of where explicit use of SFC methods might be useful in these literatures?

Social reproduction of the household (cont.)

- Human capital literature shows that financing of accumulation matters as does (contra Braunstein et al., 2011, EN 5) the interest rate
- Human capital literature based on 'tight' connection between demand and supply, in which any expenditure on human capital augments the stock of human capital available on the supply side
  - this tight connection broken in human capacities literature by short run assumption
  - also, no connection between unpaid time devoted to H_c and size/composition of household expenditures (e.g., on inputs needed to complement unpaid labour in the domestic production of H_c)

Distribution and growth: the role of potential output growth

- Technical change can connect distribution to *potential* rate of growth:
  - potential rate of growth (Harrodian natural rate) affected by labour productivity growth
  - labour productivity growth affected by distribution if technical change is induced (by profit squeeze) and factor biased (labour-saving)

Distribution and growth: the role of potential output growth

- If $g = y_p$ in the steady state, this connects distribution to *actual* rate of growth, but via *supply side* rather than traditional PK demand-side channel (Petach and Tavani, 2020; Luzuriaga and Tavani, 2021; Rada et al., 2021; Michl and Tavani, 2021; Rada et al., 2022)
- May give rise to growth that is profit-led in medium run, but wage-led in long-run steady state (see, e.g. Rada et al., 2021)

Distribution and growth: the role of potential output growth (cont.)

Suppose that:

$$g = g^s$$

$$g^s = s_\pi r$$

$$r = \frac{1}{v}(1 - \omega)$$

Then $\uparrow w \Rightarrow \uparrow \omega = wa = \frac{w}{Q} \Rightarrow \downarrow r \Rightarrow \downarrow g$ – growth profit-led

Distribution and growth: the role of potential output growth (cont.)

Note:

- No formal principle of effective demand (PED) in this model – essentially classical Marxian
- BUT – this just an abstraction for the sake of simplicity
  - think of profit-led growth scenarios in Bhaduri-Marglin model, or neo-Goodwinian model, in both of which PED is alive and well

Distribution and growth: the role of potential output growth (cont.)

Now write:

$$y_p = -\hat{a} + n = q + n$$

$$q = \gamma\omega = \gamma\frac{w}{Q} \quad , \quad \gamma > 0$$

$$\hat{w} = q + \delta(g - y_p)$$

Distribution and growth: the role of potential output growth (cont.)

Note that in the steady state:

$$g = y_p$$

(constant rate of employment)

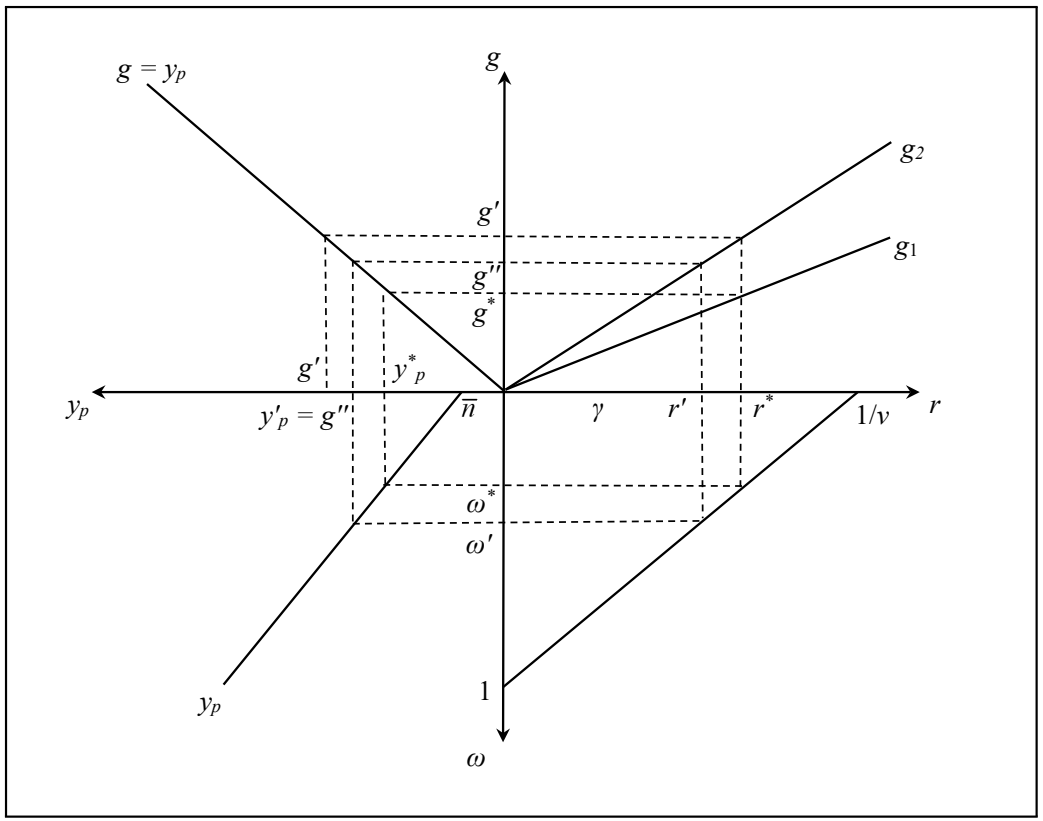
$$\Rightarrow \hat{w} = q$$

which renders the wage share ($\omega = wa = \frac{w}{Q}$) constant

BUT – now assume $\downarrow s_\pi \Rightarrow \uparrow g \Rightarrow g > y_p$ initially. Two effects:

Distribution and growth: the role of potential output growth (cont.)

- $\hat{w} > q \Rightarrow \uparrow \omega = wa = \frac{w}{Q} \Rightarrow \downarrow r \Rightarrow \downarrow g$ (profit-led growth effect)
- $\hat{w} > q \Rightarrow \uparrow \omega = wa = \frac{w}{Q} \Rightarrow \uparrow q \Rightarrow \uparrow y_p$ (induced, factor-biased technical change effect)



Distribution and growth: the role of potential output growth (cont.)

- RESULT – steady-state equilibrium restored when $g'' = y'_p$, such that $g' > g'' = y'_p > y^*_p = g^*$
- In other words,
  - although growth profit-led in medium run ($g'' < g'$ due to $\uparrow \omega$)...
  - ... steady-state rate of growth *increases* in response to $\uparrow \omega$ ($g'' = y'_p > y^*_p = g^*$) – wage-led!
- Note consistency with Blecker (2016): growth more likely to be wage-led in long run

Distribution and growth: the role of potential output growth (cont.)

Some complications

- Zamparelli (2022) – does profit squeeze elicit *increase* in productivity growth?
  - if not, key mechanism making for wage-led long-run growth undermined
  - Zamparelli (2022) result obviously has implications far beyond the core (Rada et al., 2021) result

Distribution and growth: the role of potential output growth (cont.)

- The Verdoorn law
  - falling actual rate of growth would *retard* productivity growth and so *reduce* the natural rate through this channel
  - natural rate may experience *net decline* as a result
  - system may become unstable and, even if not, steady-state growth will be profit-led
  - the old controversy reappears, the supply side now the 'battleground'!

Distribution and growth: the role of potential output growth (cont.)

Now note the link between this literature and the human capacities (and hence human capital) literature:

- Rada et al. (2021): $\Delta\pi$ affects steady-state g via g *and* y_p
- Braunstein et al. (2011): ditto, but with bells on!
  - $\Delta\pi$ affects I_k, I_{H_c} on demand side ...
  - ... and $Q = Q[.]$ on supply side, both through traditional channel (induced, factor-biased technical change) *and* new channel (quantity of unpaid care-giving in the home)
  - indeed, effects of $\Delta\pi$ may vary depending on its effects on f and m and hence division of wage income between men and women, given *gendered structure of the second channel*

Distribution and growth: the role of potential output growth (cont.)

- Result: Braunstein et al. (2011) as a (WIP) extension of Rada et al. (2021)
  - WIP because Braunstein et al. (2011) is a short-run model whereas Rada et al. (2021) is a fully-realized model of short-run Goodwin dynamics *and* long-run steady-state trend growth outcomes
  - \$64K question: how does redistribution affect (steady-state) growth in this extended framework?

Summary and conclusions

- On the face of it, this has been a discussion of four essentially unrelated topics:
  - one old established theme (reconciliation of AD and AS in the long run) ...
  - ... and three new and small (but important in their own right) literatures, on human capital, the social reproduction of labour, and the supply-side link between distribution and growth

Summary and conclusions (cont.)

- BUT – in addition to *primary* topics of interest in the three new literatures (education, gender and care, the distribution-growth-technical change nexus), all three serve a *secondary* purpose:
  - they relate back to the old (AD-AS reconciliation) theme, by showing how we might get $g = y_p$ through new mechanisms ...
  - ... and provide new insights into (even older) theme – debate over wage- versus profit-led growth
- Moreover, *feminist-structuralist macro theory seems to provide a general framework for further (and integrated) exploration of all this*

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