



Neo-Keynesian Growth Models

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Neo-Keynesian Growth Models

- Labour supply is inelastic, so economic growth is limited by the growth rate of labour force in the long run.
- Firms operate with a normal level of capacity utilization, which means that there is no unintended excess capacity (all excess capacity is planned or “normal”).
- These models do not have a clear and unique explanation for unequal development.
- These models are derived from the works of Nicholas Kaldor (1956, 1957) and Luigi Pasinetti (1961).
 - Growth rate of real output is determined by the so called natural growth rate, which is given by the sum of growth rate of labour force and the growth rate of labour productivity.
 - The differences of growth performance between countries is explained by these models as a result of technological asymmetries, that are expressed by the level of technological gap.
 - The concept of technological gap is due to Fagerberg (1988) and Verspagen (1993).
 - The adjustment of saving to the level of investment is obtained through the adjustment of income distribution between wages and profits.

The Basic set-up of the neo-keynesian growth models

$$Y = \min(aL; uvK) \quad (1)$$

$$Y = aL = uvK \quad (2)$$

$$L = \frac{1}{a}Y \quad (3)$$

$$\hat{L} = \hat{Y} - \hat{a} \quad (4)$$

$$\hat{Y} = \eta + \hat{a} \quad (5)$$

$$g_N = \eta + \hat{a} \quad (6)$$

$$\hat{a} = \alpha_0 + \alpha_1 \hat{k} \quad (7)$$

$$\alpha_1 = a_2 G e^{-\frac{G}{\delta}} \quad (8)$$

$$G = \frac{T_N}{T_S}$$

The Technical Progress Function I

- The term α_0 in equation (7) represents the share of technical progress that is autonomous in relation to the capital accumulation effort.
- It is, therefore, part of the technical progress that is disembodied from machinery and equipment; that is, it is the productivity gains resulting from organizational changes that allow an increase of production without the realization of additional investment.
- The term $\alpha_1 k$, in turn, represents the share of technical progress that is incorporated into machines and equipment, and is therefore induced by the capital accumulation effort.
- The coefficient α_1 represents the sensitivity of the growth rate of labor productivity to changes in the growth rate of capital stock per worker.
- This coefficient captures the ability to transform the flow of new ideas and knowledge into increased productivity through investment
- This coefficient of induction of productivity growth by capital accumulation depends, in turn, on the size of the so-called technological gap, that is, the distance between the level of technological knowledge possessed by the economy in regard to the technological frontier.

The Technical Progress Function II

- What is the relation between the technological gap and the coefficient of induction of the function of technical progress?
- To a certain extent, countries behind the technological frontier can rapidly increase their productivity simply by imitating and learning the production methods employed by countries at the technological frontier; that is, within certain limits, the growth rate of labor productivity of an economy behind the technological frontier is a positive function of the distance that separates it with respect to that same frontier.
- As imitation involves, at least in part, the purchase of machinery and equipment produced in countries bordering the frontier; it follows that the coefficient of induction of the function of technical progress must depend on the size of the technological gap.
- In this way, countries behind the technological frontier may benefit from the positive overflow effects of the technical knowledge possessed by the leading countries in technology.
- It should be emphasized, however, that this positive relationship between the induction coefficient of the technical progress function and the technological gap depends on the learning ability or absorptive capacity possessed by a country.
- The absorptive capacity, in turn, depends on the very distance that the country is in relation to the technological frontier. If this distance is too large, then the country will not be able to take advantage of the positive overflow effects of the leading technology countries.
- In this case, the coefficient of induction of the function of technical progress will be a decreasing function of the technological gap

Dynamics of capital stock per-worker and labour productivity growth

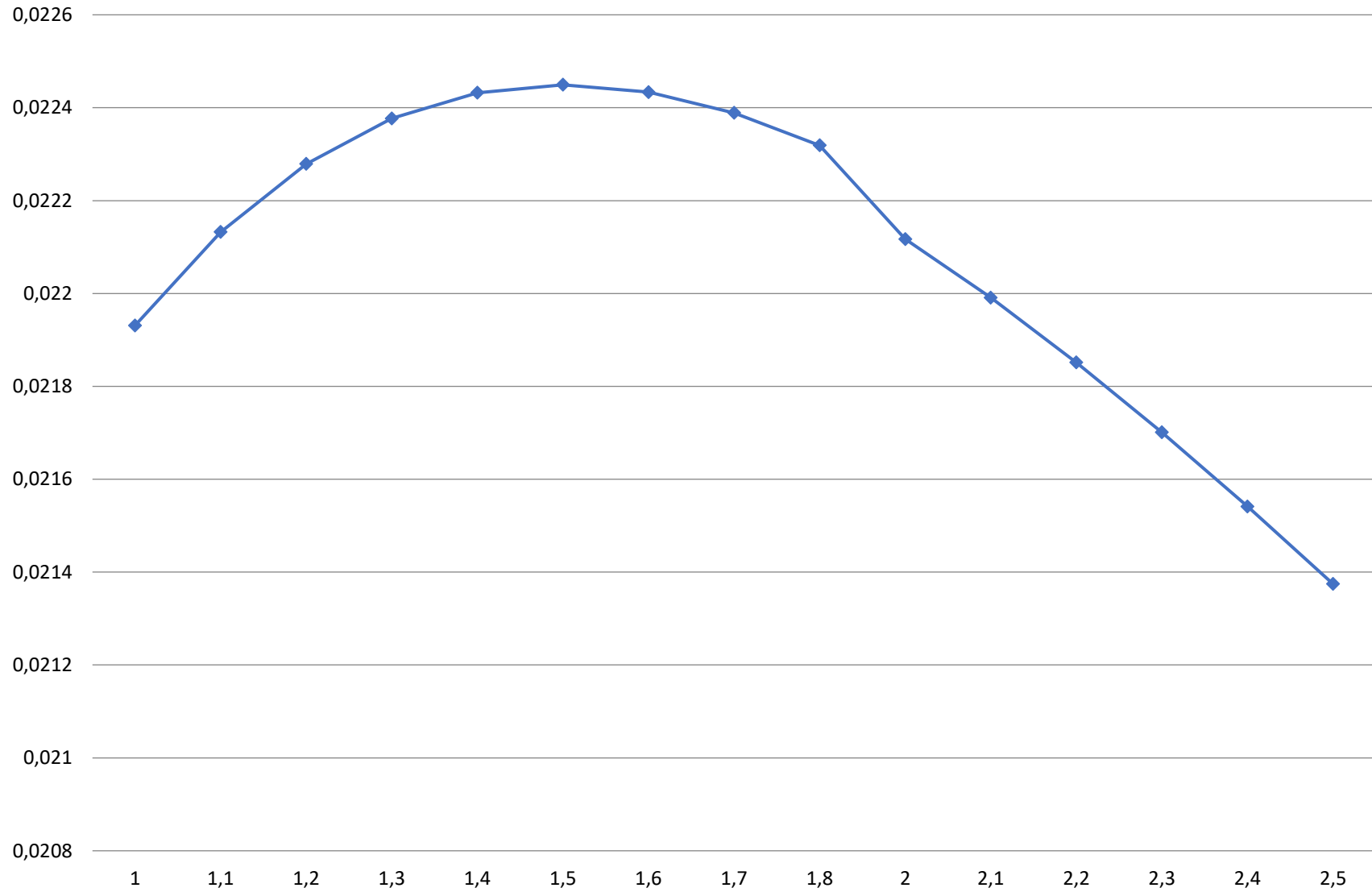
$$\hat{k} = \hat{K} - n \quad (10)$$

$$\hat{a} = \alpha_0 + \left(a_2 G e^{-\frac{G}{\delta}} \right) (g_k - n) \quad (11)$$

A numerical example

- A numerical example can help us visualize the relationship between the rate of growth of labor productivity and the technological gap.
- Consider an economy in which the coefficient α_0 representing the disembodied portion of technological progress equals 0.01.
- Assume also that $\alpha_2 = 0.8$ and that the parameter δ that represents the technological learning capacity (also known as absorptive capacity) is equal to 1.5.
- Finally, suppose that the capital stock grows at a rate of 2% a.a and the labor force grows at a rate of 1.0% a.a.
- The visualization of the relation between the rate of growth of labor productivity and the technological gap can be made by figure 1 in the next slide.

Figure 1 -Rate of growth of labor productivity as a function of the technological gap



Capital Accumulation and Balanced Growth

$$Y = uvK \quad (12)$$

$$g_Y = g_u + g_v + g_K \quad (13)$$

$$g_Y = g_K \quad (14)$$

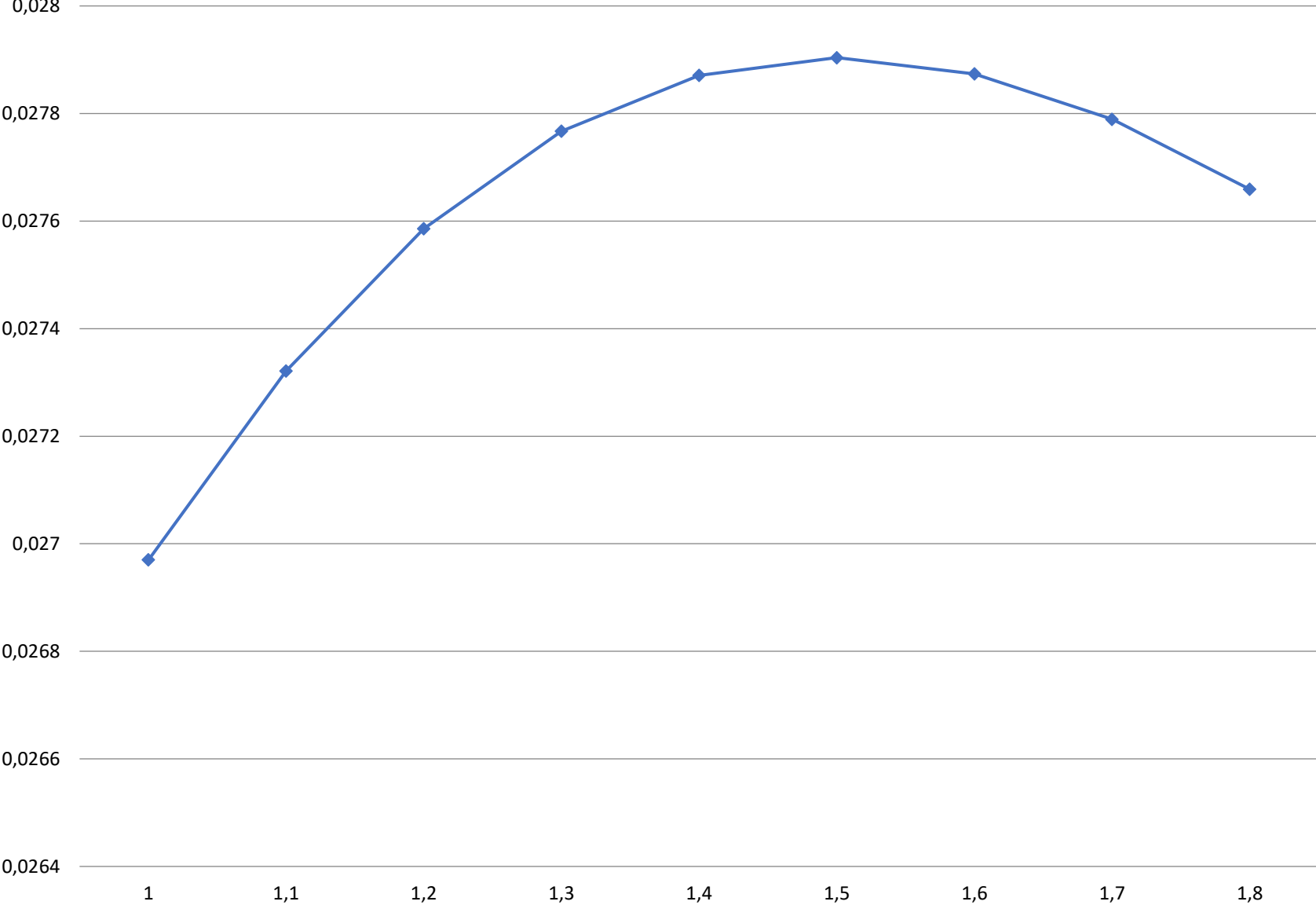
$$g_N = \left(1 - \left(a_2 G e^{-\frac{G}{\delta}}\right)\right)n + \alpha_0 + \left(a_2 G e^{-\frac{G}{\delta}}\right)g_K \quad (15)$$

$$g_N = n + \frac{\alpha_0}{\left(1 - \left(a_2 G e^{-\frac{G}{\delta}}\right)\right)} \quad (16)$$

A numerical example

- A numerical example can help us visualize the relationship between the natural rate of growth and the technological gap.
- Consider an economy in which the labor force grows at a rate of 1.0 per cent a.a.
- The coefficient α_0 representing the disembodied portion of technological progress equals 0.01.
- Assume also that $\alpha_2 = 0.8$ and that the parameter δ that represents the capacity of technological learning is equal to 1,5.
- Figure 2 in the next slide shows the natural growth rate of the economy under consideration for a constellation of values of the technological gap

Figure 2 - Natural Growth Rate as a function of the Technological GAP



Investment and total, household and firm savings

$$I = \bar{I} \quad (17)$$

$$S = S_F + S_H \quad (18)$$

$$S_H = S_W + S_C \quad (19)$$

$$S_W = s_w(W + P_w) \quad (20)$$

$$S_C = s_c P_C \quad (21)$$

$$S_F = P_R \quad (22)$$

$$P_R = \varepsilon P \quad (23)$$

$$P = P_R + P_D \quad (24)$$

$$P_D = P_W + P_C \quad (25)$$

$$P_w = k_w P_D \quad (26)$$

$$P_C = (1 - k_w) P_D \quad (27)$$

$$S = \{\varepsilon + (1 - \varepsilon)[s_w k_w + s_c(1 - k_w)]\}rK + s_w W \quad (31)$$

Different Closures for the Neo-Keynesian Growth Model

- From equation (31) we can derive four particular cases, namely:
 - Ricardian saving function: workers propensity to save is equal to zero and all profits are distributed.
 - Harrodian saving function: workers and capitalists propensities to save are equal and all profits are distributed.
 - Pasinettian saving function: Workers have a non-zero propensity to save but lower than capitalists propensity to save. All profits are distributed.
 - Kaldorian saving function: Firms retained a share of the total profits, but all households (capitalists or workers) had the same propensity to save. The retained profits coefficient is higher than households propensity to save.

Balanced Growth under Kaldorian Closure

$$g_N = n + \frac{\alpha_0}{\left(1 - \left(a_2 G e^{-\frac{G}{\delta}}\right)\right)} \quad (16)$$

$$\sigma = \{\varepsilon + (1 - \varepsilon)s_F\}huv + s_F(1 - h)uv \quad (31a')$$

$$u = u^n \quad (34)$$

$$g_K = g_Y \quad (14)$$

$$g_Y = g_N \quad (14a)$$

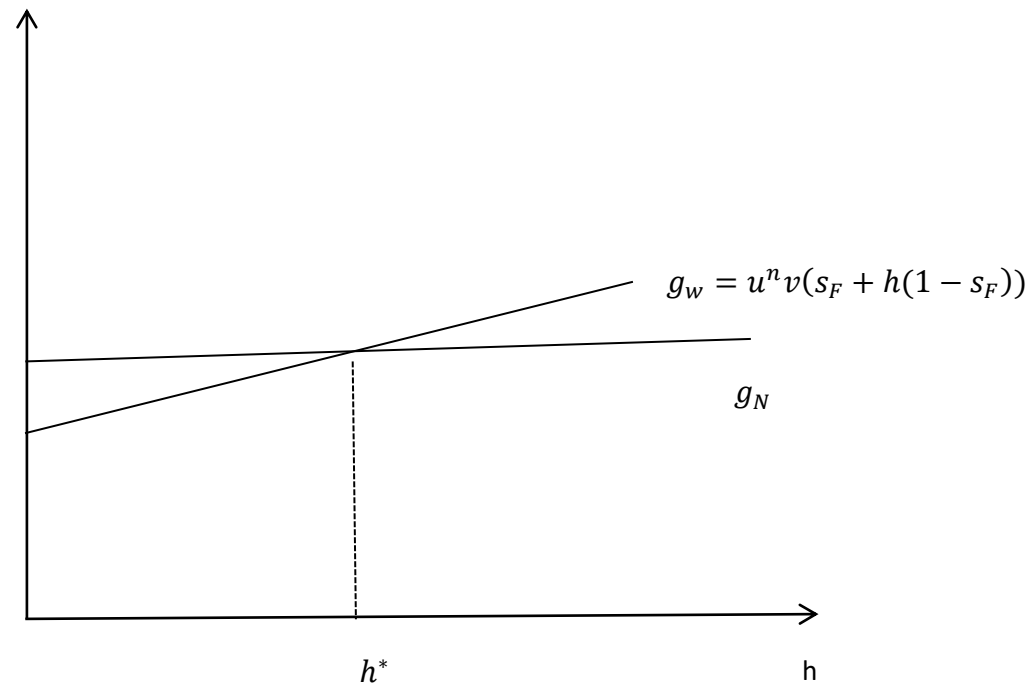
$$g_K = \sigma \quad (33)$$

$$g_w = u^n v(s_F + h(1 - s_F)) \quad (41)$$

Balanced Growth under Kaldorian Closure

- An important distinction with respect to the Harrodian model is that savings as a fraction of the capital stock is no longer a constant but varies with the functional distribution of income between wages and profits.
- Thus, a mechanism is established by which the warranted rate of growth can adjust to the natural rate, thus guaranteeing the existence of a balanced growth trajectory in the long term.
- In equation (41) we observe that given the normal degree of utilization of productive capacity, the potential-capital-output ratio and propensity to save of households, the warranted rate of growth is a growing function of income share of income.
- This is because being the aggregate propensity to save the weighted average by the share of the profits in the income between the propensity to save of the firms (equal to one) and the propensity to save of households; an increase in the share of profits in income will redistribute income from the lower propensity to save units (the households) to the higher propensity to save units (the firms), thus leading to an increase in the aggregate propensity to save and, therefore, warranted rate of growth

Balanced Growth in the Neo-Keynesian (Kaldorian) Growth Models

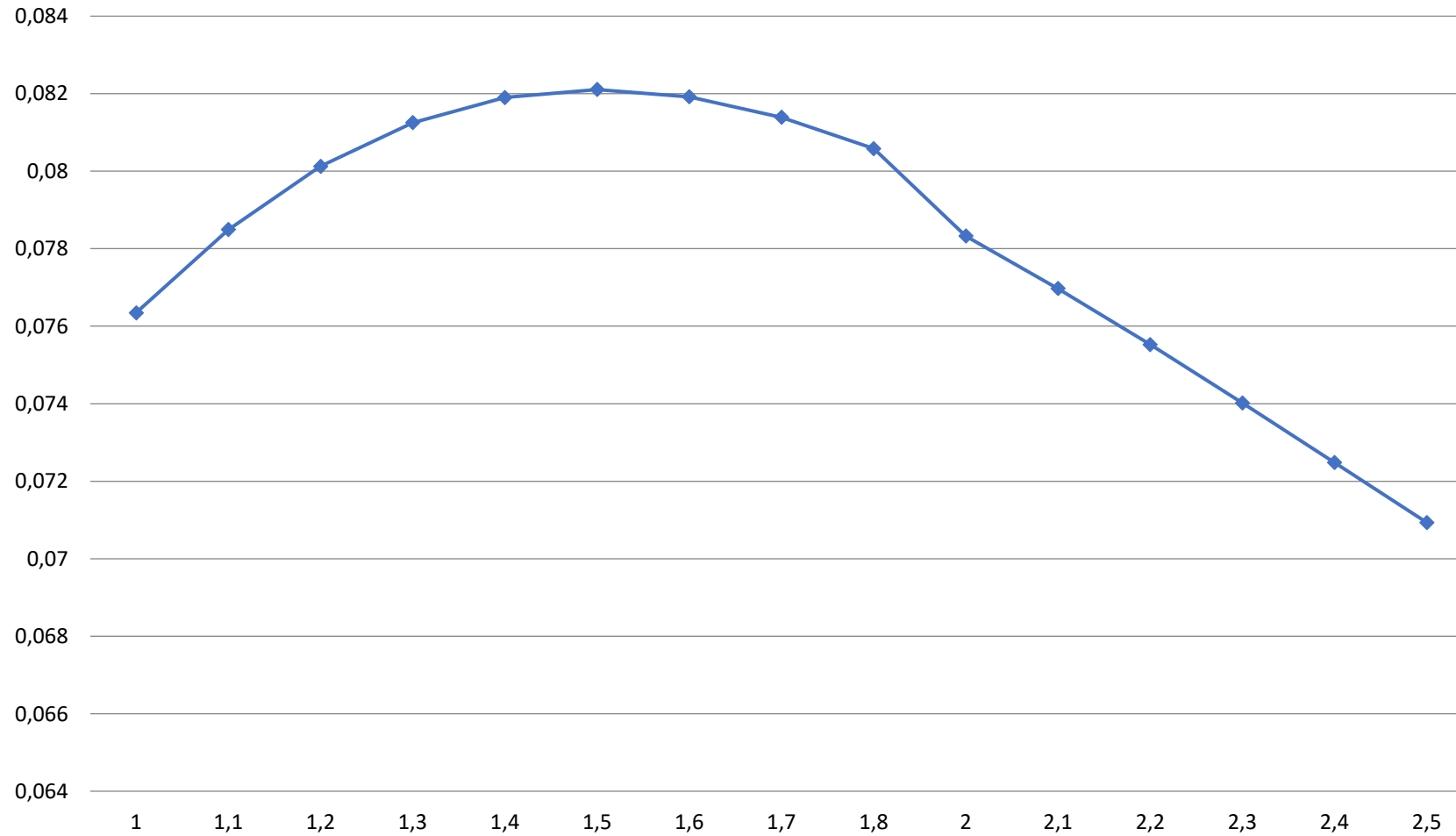


Income Distribution as a Function of Technological Gap

$$h^* = \left(\frac{1}{1 - s_f} \right) \left\{ \frac{n}{u^n v} + \frac{\alpha_0}{u^n v \left(1 - \alpha_2 G e^{-\frac{G}{\delta}} \right)} \right\} - \left(\frac{s_F}{1 - s_F} \right) \quad (42)$$

Numerical Example

Figure 5 - Profit share in income as a function of technological gap



Profit-Led Growth

- In neo-keynesian growth models, regardless of the specification of the saving function, the accumulation regime is clearly profit-led.
- Indeed, an exogenous increase in the natural rate of growth - due, for example, to an increase in the rate of growth of the labor force - will require an increase in the rate of investment and savings.
- In order for savings to adjust to the investment that is required for the new balanced growth trajectory, the share of profits in income should increase, in order to redistribute income from the lower propensity to save units (workers/households) to higher propensity to save units (Capitalists/firms).
- In this way, aggregate saving will increase by adjusting to the level of investment that is required to sustain a higher growth rate in the new trajectory of balanced growth.
- In Figure 7 we present the correlation between the natural growth rate of real output (equal to the capital stock growth rate along the balanced growth trajectory) and the profit share in income for the case of the Pasinettian model.

Figure 7 - Correlation between the Natural Growth Rate and the Profit Share of Income

