Hochschule für
Wirtschaft und Recht Berlin
Berlin School of Economics and Law

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DISTRIBUTION AND GROWTH AFTER KEYNES

A Post-Keynesian Guide

(Edward Elgar 2014)

CHAPTER 9
'EXTENDING KALECKIAN MODELS III:
INTEREST AND CREDIT'

Content

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9.1 INTRODUCTION

- Explicit consideration of money, credit and interest

- Following post-Keynesian horizontalist view: exogenous rate of interest and endogenous credit and money (Kaldor 1970a, 1982, 1985a, Lavoie, 1984, 1992, 1996c, Moore 1988, 1989)

- Introduction of monetary variables into post-Keynesian distribution and growth models only since 1980s (Taylor 1985, Dutt 1989, 1990/91, Epstein 1992, Lavoie 1992, 1993, …)

- Systematic introduction of interest and credit into different version of post-Keynesian/Kaleckian models in Hein (2008)

9.2 THE THEORETICAL MODEL

9.2.1 The basic model

Table 9.1 Balance sheet matrix

	Workers' households	Rentiers' households	Firms	Σ
Loans		+B	-B	0
Capital			pK	pK
Σ	0	+B	$+E_F$	$pK = B+E_F$

Table 9.2 Transaction flow matrix

	Workers' households	Rentiers' households	Firms' current	Firms' capital	Σ
Consumption	$-pC_w$	$-pC_R$	$+pC_w+pC_R$		0
Investment			+pI	-pI	0
Wages	+W		-W		0
Retained profits			$-\Pi_F$	$+dE_F$	0
Distributed profits: interest		+R	-R		0
Change in loans		-dB		+dB	0
Σ	0	0	0	0	0

(9.1) $$r = \frac{\Pi}{pK} = \frac{\Pi}{pY}\frac{Y}{Y^p}\frac{Y^p}{K} = \frac{pY - wL}{pY}\frac{Y}{Y^p}\frac{Y^p}{K} = \left(1 - w^r a\right)\frac{u}{v} = h\frac{u}{v}$$

r: profit rate, Π: gross profits, p: price, K: real capital stock, Y: real output, Y^p : real potential output, w: nominal wage rate, L: labour, a: labour-output ratio, u: capital-potential output ratio, h: profit share

(9.2) $$p = \left[1 + m(i)\right]wa, \qquad m > 0, \frac{\partial m}{\partial i} \geq 0.$$

m: mark-up, i: rate of interest

(9.3) $$h = \frac{\Pi}{pY} = 1 - \frac{1}{1 + m(i)}, \quad \frac{\partial h}{\partial i} \geq 0$$

(9.4) $$pK = B + E_F$$

B: long-term credit E_F: firms' accumulated retained earnings

(9.5) $$\lambda = \frac{B}{pK}$$

λ: debt-capital ratio

(9.6) $$\Pi = \Pi_F + R$$

Π_F: retained profits of firms, R: rentiers' income

(9.7) $$R = iB$$

(9.8) $$\sigma = \frac{S}{pK} = \frac{\Pi - R + S_R}{pK} = h\frac{u}{v} - i\lambda(1 - s_R), \qquad 0 < s_R \leq 1$$

σ: saving rate, S: total saving, S_R: saving out of rentiers' income, s_R: propensity to save out of rentiers' income

(9.9) $$g = \frac{I}{K} = \alpha + \beta u + \tau h - \theta i \lambda, \qquad \beta, \tau, \theta > 0$$

g: rate of capital accumulation

(9.10) $$g = \sigma$$

(9.11) $$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} > 0 \quad \Rightarrow \quad \frac{h}{v} - \beta > 0.$$

9.2.2 Short-run equilibrium

$$(9.12)\quad u^* = \frac{i\lambda\left(1-s_R-\theta\right)+\alpha+\tau h}{\frac{h}{v}-\beta}$$

$$(9.13)\quad g^* = \frac{i\lambda\left[\beta\left(1-s_R\right)-\theta\frac{h}{v}\right]+\frac{h}{v}\left(\alpha+\tau h\right)}{\frac{h}{v}-\beta}$$

$$(9.14)\quad r^* = \frac{\frac{h}{v}\left[i\lambda\left(1-s_R-\theta\right)+\alpha+\tau h\right]}{\frac{h}{v}-\beta}$$

The effects of a change in the profit share

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(9.12a) $$\frac{\partial u^*}{\partial h} = \frac{\tau - \frac{u}{v}}{\frac{h}{v} - \beta}$$

(9.13a) $$\frac{\partial g^*}{\partial h} = \frac{\frac{1}{v}\left(\tau h - \beta u\right)}{\frac{h}{v} - \beta}$$

(9.14a) $$\frac{\partial r^*}{\partial h} = \frac{\frac{1}{v}\left(\tau h - \beta u\right)}{\frac{h}{v} - \beta}$$

(9.12a') $$\frac{\partial u^*}{\partial h} > 0, \qquad \text{if :} \qquad \tau - \frac{u}{v} > 0$$

(9.13a') $$\frac{\partial g^*}{\partial h} > 0, \qquad \text{if :} \qquad \tau\left(\frac{h}{v\beta}\right) - \frac{u}{v} > 0$$

(9.14a') $$\frac{\partial r^*}{\partial h} > 0, \qquad \text{if :} \qquad \tau\left(\frac{h}{v\beta}\right) - \frac{u}{v} > 0$$

Table 9.3 Effects of changes in the profit share on the short-run equilibrium rates of capacity utilization, capital accumulation and profit

	$\frac{\partial u^*}{\partial h}$	$\frac{\partial g^*}{\partial h}$	$\frac{\partial r^*}{\partial h}$
Wage-led regime			
Wage-led demand and wage-led accumulation/ growth: $\tau - \frac{u}{v} < \tau\left(\frac{h}{v\beta}\right) - \frac{u}{v} < 0$	–	–	–
Intermediate regime			
Wage-led demand and profit-led accumulation/ growth: $\tau - \frac{u}{v} < 0 < \tau\left(\frac{h}{v\beta}\right) - \frac{u}{v}$	–	+	+
Profi-led regime			
Profit-led demand and profit-led accumulation/ growth: $0 < \tau - \frac{u}{v} < \tau\left(\frac{h}{v\beta}\right) - \frac{u}{v}$	+	+	+

The effects of a change in the interest rate

(9.12b) $$\frac{\partial u^*}{\partial i} = \frac{\lambda\left(1-s_R-\theta\right)+\frac{\partial h}{\partial i}\left(\tau-\frac{u}{v}\right)}{\frac{h}{v}-\beta}$$

(9.13b) $$\frac{\partial g^*}{\partial i} = \frac{\lambda\left[\beta\left(1-s_R\right)-\theta\frac{h}{v}\right]+\frac{\partial h}{\partial i}\frac{1}{v}\left(\tau h-\beta u\right)}{\frac{h}{v}-\beta}$$

(9.14b) $$\frac{\partial r^*}{\partial i} = \frac{\frac{h}{v}\lambda\left(1-s_R-\theta\right)+\frac{\partial h}{\partial i}\frac{1}{v}\left(\tau h-\beta u\right)}{\frac{h}{v}-\beta}$$

Table 9.4 Effects of changes in the interest rate on the short-run equilibrium rates of capacity utilization, capital accumulation and profit with an interest-inelastic profit share

	$\frac{\partial u^*}{\partial i}$	$\frac{\partial g^*}{\partial i}$	$\frac{\partial r^*}{\partial i}$
Normal case			
$\frac{\beta v}{h}(1-s_R)-\theta<(1-s_R)-\theta<0$	−	−	−
Intermediate case			
$\frac{\beta v}{h}(1-s_R)-\theta<0<(1-s_R)-\theta$	+	−	+
Puzzling case			
$0<\frac{\beta v}{h}(1-s_R)-\theta<(1-s_R)-\theta$	+	+	+

Interest-inelastic profit share

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(9.12b') $$\frac{\partial u^*}{\partial i} > 0, \qquad \text{if:} \qquad (1 - s_R) - \theta > 0$$

(9.13b') $$\frac{\partial g^*}{\partial i} > 0, \qquad \text{if:} \qquad \frac{\beta v}{h}(1 - s_R) - \theta > 0$$

(9.14b') $$\frac{\partial r^*}{\partial i} > 0, \qquad \text{if:} \qquad (1 - s_R) - \theta > 0$$

Table 9.5 Responses of the profit share, the rate of capacity utilization, the rate of accumulation and the rate of profit to a variation in the interest rate: stable short-run equilibria

	$\frac{\partial u}{\partial i}$	$\frac{\partial g}{\partial i}$	$\frac{\partial r}{\partial i}$
$\frac{\partial h}{\partial i} = 0$	$\frac{\partial u}{\partial i} > 0, \text{if}$ $1 - s_R - \theta > 0$	$\frac{\partial g}{\partial i} > 0, \text{if}$ $\beta(1 - s_R) - \theta \frac{h}{v} > 0$	$\frac{\partial r}{\partial i} > 0, \text{if}$ $1 - s_R - \theta > 0$
$\frac{\partial h}{\partial i} > 0$	$\frac{\partial u}{\partial i} > 0, \text{if}$ $\lambda(1 - s_R - \theta)$ $+ \frac{\partial h}{\partial i}\left(\tau - \frac{u}{v}\right) > 0$	$\frac{\partial g}{\partial i} > 0, \text{if}$ $\lambda\left[\beta(1 - s_R) - \theta \frac{h}{v}\right]$ $+ \frac{\partial h}{\partial i}\frac{1}{v}(\tau h - \beta u) > 0$	$\frac{\partial r}{\partial i} > 0, \text{if}$ $\frac{h}{v}\lambda(1 - s_R - \theta)$ $+ \frac{\partial h}{\partial i}\frac{1}{v}(\tau h - \beta u) > 0$

The effects of a change in the debt-capital ratio

(9.12c) $$\frac{\partial u^*}{\partial \lambda} = \frac{i\left(1 - s_R - \theta\right)}{\frac{h}{v} - \beta}$$

(9.13c) $$\frac{\partial g^*}{\partial \lambda} = \frac{i\left[\beta\left(1 - s_R\right) - \theta\frac{h}{v}\right]}{\frac{h}{v} - \beta}$$

(9.14c) $$\frac{\partial r^*}{\partial \lambda} = \frac{\frac{h}{v} i\left(1 - s_R - \theta\right)}{\frac{h}{v} - \beta}$$

(9.12c') $\frac{\partial u^*}{\partial \lambda} > 0, \qquad \text{if :} \qquad (1 - s_R) - \theta > 0$

(9.13c') $\frac{\partial g^*}{\partial \lambda} > 0, \qquad \text{if :} \qquad \frac{\beta_V}{h}(1 - s_R) - \theta > 0$

(9.14c') $\frac{\partial r^*}{\partial \lambda} > 0, \qquad \text{if :} \qquad (1 - s_R) - \theta > 0$

Table 9.6 Effects of changes in the exogenous debt-capital ratio on the short-run equilibrium rates of capacity utilization, capital accumulation and profit

	$\frac{\partial u^*}{\partial \lambda}$	$\frac{\partial g^*}{\partial \lambda}$	$\frac{\partial r^*}{\partial \lambda}$
Debt-burdened rates of capacity utilization, capital accumulation/growth and profit $\frac{\beta v}{h}(1-s_R)-\theta<(1-s_R)-\theta<0$	–	–	–
Debt-led rates of capacity utilization and profit, and debt-burdened rate of capital accumulation/growth $\frac{\beta v}{h}(1-s_R)-\theta<0<(1-s_R)-\theta$	+	–	+
Debt-led rates of capacity utilization, capital accumulation/growth and profit $0<\frac{\beta v}{h}(1-s_R)-\theta<(1-s_R)-\theta$	+	+	+

9.2.3 Long-run equilibrium

Endogenous determination of the debt-capital ratio

Assumption: constant prices, but mark-up may vary

From equation (9.5):

(9.15) $$\hat{\lambda} = \hat{B} - \hat{K} = \hat{B} - g$$

(9.16) $$dB = S_R = s_R iB$$

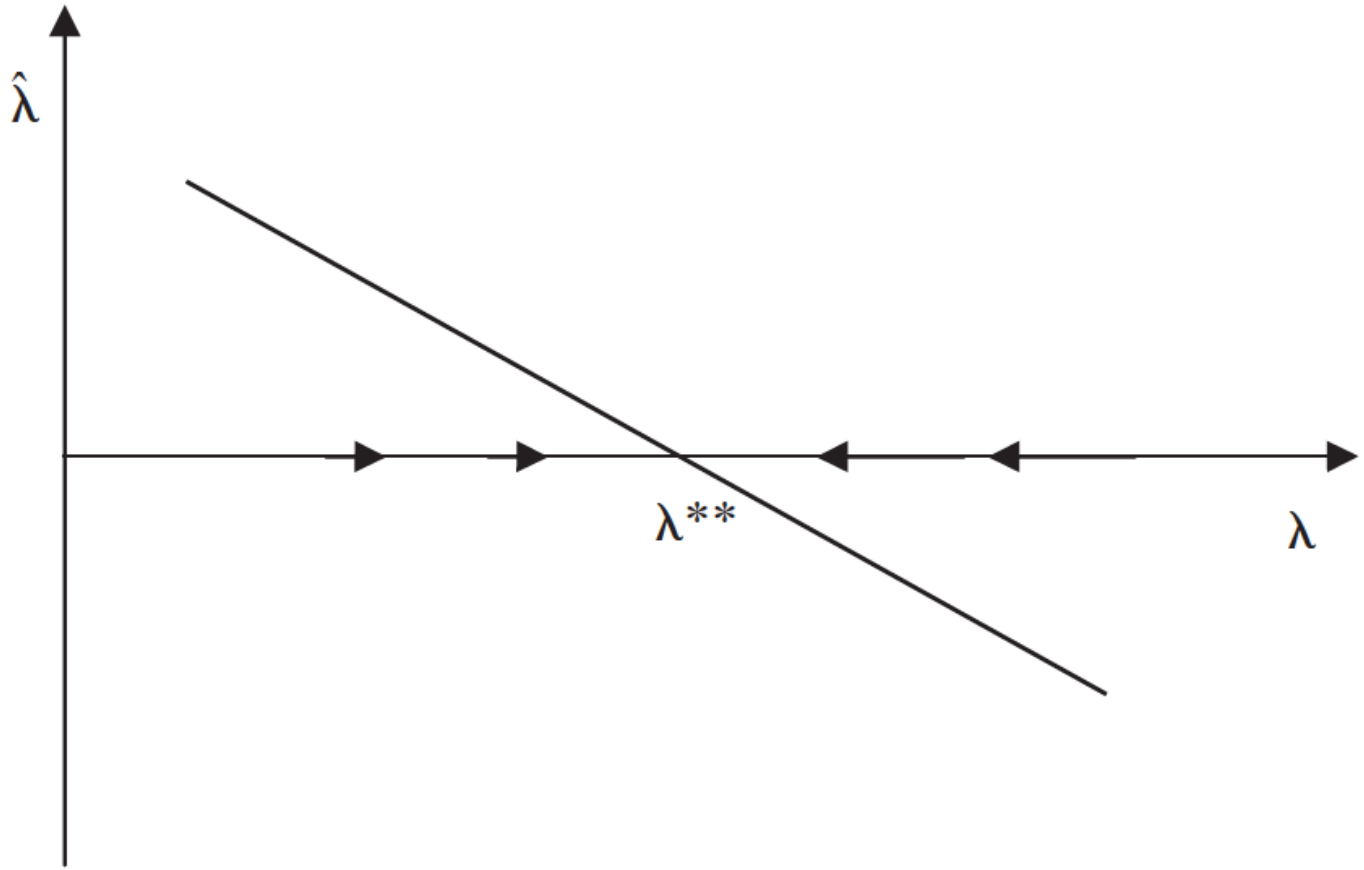
(9.17) $$\hat{B} = \frac{dB}{B} = s_R i$$

For long-run equilibrium: $\hat{\lambda} = 0$

- Applying this condition to equation (9.15) and making use of (9.13) and (9.17) yields:

$$(9.18)\quad \lambda^{**} = \frac{s_R i\left(\frac{h}{v} - \beta\right) - \frac{h}{v}(\alpha + \tau h)}{i\left[\beta(1 - s_R) - \theta\frac{h}{v}\right]}$$

Figure 9.1 Stability of the long-run equilibrium debt-capital ratio



Stability of long-run equilibrium debt-capital ratio:

(9.15a) $$\frac{\partial \hat{\lambda}}{\partial \lambda} = \frac{-i\left[\beta\left(1-s_R\right)-\theta\frac{h}{v}\right]}{\frac{h}{v}-\beta}$$

Stable case

(9.15a') $$\frac{\partial \hat{\lambda}}{\partial \lambda} < 0, \qquad \text{if:} \qquad \beta\left(1-s_R\right)-\theta\frac{h}{v} > 0$$

Unstable case

(9.15a'') $$\frac{\partial \hat{\lambda}}{\partial \lambda} > 0, \qquad \text{if:} \qquad \beta\left(1-s_R\right)-\theta\frac{h}{v} < 0$$

Long-run equilibrium capital accumulation

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From equations (9.15) and (9.17)

(9.19) $g^{**} = s_R i$

g^{**}: warranted rate of growth

Long run stable case: $\beta(1-s_R)-\theta h/v > 0$,

- A deviation of g^* in equation (9.13) from g^{**} in equation (9.19) will be self-correcting:
- If $g^* > g^{**}$, λ will fall according to equation (9.15) and this will feed back negatively on g^* in equation (9.13), adjusting g^* to g^{**}.
- If $g^* < g^{**}$, λ will rise according to equation (9.15) and this will feed back positively on g^* in equation (9.13), adjusting g^* to g^{**}.

Long-run unstable case: $\beta(1-s_R)-\theta h/v < 0$,

- A deviation of g^* in equation (9.13) from g^{**} in equation (9.19) will be cumulatively accelerating:
- If $g^* > g^{**}$, λ will fall according to equation (9.15) and this will feed back positively on g^* in equation (9.13), making g^* deviate even further from g^{**}.
- If $g^* < g^{**}$, λ will rise according to equation (9.15) and this will feed back negatively on g^* in equation (9.13), making g^* deviate even further from g^{**}.

- **'paradox of debt'** (Steindl 1952)

9.2.4 The effect of a higher rate of interest on the long-run equilibrium

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If higher interest rate triggers a higher profit share, stable financial structure may turn unstable (9.15a)

Assumption: interest-inelastic profit share

(9.18a) $$\frac{\partial \lambda^{**}}{\partial i} = \frac{\frac{h}{v}(\alpha + \tau h)}{i^2\left[\beta(1-s_R) - \theta\frac{h}{v}\right]}$$

For long-run stable equilibrium

(9.18a') $$\frac{\partial \lambda^{**}}{\partial i} = \frac{\frac{h}{v}(\alpha + \tau h)}{i^2\left[\beta(1-s_R) - \theta\frac{h}{v}\right]} > 0$$

For long-run unstable equilibrium

(9.18a'') $$\frac{\partial \lambda^{**}}{\partial i} = \frac{\frac{h}{v}(\alpha + \tau h)}{i^2\left[\beta(1-s_R) - \theta\frac{h}{v}\right]} < 0$$

(9.19a) $$\frac{\partial g^{**}}{\partial i} = s_R > 0$$

Table 9.7 Effects of interest rate variations with an interest-inelastic profit share on capital accumulation and debt-capital ratio: stable and unstable long-run equilibria

		$\beta(1-s_R)-\theta\frac{h}{v}$	
		+	–
1. Interest rate and short-run equilibrium accumulation rate	$\frac{\partial g^*}{\partial i}$, equation (13b)	+ (puzzling case)	– (normal or intermediate case)
2. Debt-capital ratio and short-run equilibrium accumulation rate	$\frac{\partial g^*}{\partial \lambda}$, equation (13c)	+ (debt-led accumulation)	– (debt-burdened accumulation)
3. Interest rate and long-run equilibrium debt-capital ratio	$\frac{\partial \lambda^{**}}{\partial i}$, equation (18a)	+	–
4. Interest rate and long-run equilibrium accumulation rate (warranted rate)	$\frac{\partial g^{**}}{\partial i}$, equation (19a)	+	+
5. Stability of long-run equilibrium debt-capital ratio and of the warranted rate	$\frac{\partial \hat{\lambda}}{\partial \lambda}$, equation (15a)	– (stable)	+ (unstable)

9.2.5 Accumulation and the debt-capital ratio: the effects of an increase in animal spirits

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- Does an increase in animal spirits affect the debt-capital ratio in a systematic way, undermining the horizontalist approach regarding the rate of interest?

$$(9.13d)\quad \frac{\partial g^{*}}{\partial \alpha} = \frac{\frac{h}{v}}{\frac{h}{v} - \beta} > 0$$

$$(9.18b)\quad \frac{\partial \lambda^{**}}{\partial \alpha} = \frac{-\frac{h}{v}}{i\left[\beta(1-s_R) - \theta\frac{h}{v}\right]}$$

Long-run stable case: macroeconomic paradox of debt for equilibria

(9.18b') $$\frac{\partial \lambda^{**}}{\partial \alpha} = \frac{-\frac{h}{v}}{i\left[\beta(1-s_R)-\theta\frac{h}{v}\right]} < 0$$

Long-run unstable case: 'paradox of debt' in disequilibrium process!

(9.18b'') $$\frac{\partial \lambda^{**}}{\partial \alpha} = \frac{-\frac{h}{v}}{i\left[\beta(1-s_R)-\theta\frac{h}{v}\right]} > 0$$

(9.19b) $$\frac{\partial g^{**}}{\partial \alpha} = 0$$

- No reason to assume rising debt-capital ratios as cause for rising interest rates in the accumulation process

9.3 EMPIRICAL RESULTS ON INTEREST RATES, DISTRIBUTION, AGGREGATE DEMAND AND CAPITAL ACCUMULATION

9.3.1 Interest rate and functional income distribution

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Empirical studies:

Pollin (1986/87), Moore (1989b), Niggle (1989), Epstein/Power (2003), Epsten/Jayadev (2005) Dumenil/Levy (2005), Rochon/Rossi (2006a, 2006b)

Econometrics:

Argitis/Pitelis (2001), Marterbauer/Walterskirchn (2002), Hein/Ochsen (2003),

Hein/Schoder (2011): Germany, US (1960-2007):

- US, a one percentage point increase in the net interest payments-net nominal capital stock ratio raises the profit share by 2.44 percentage points.
- In Germany the corresponding effect is 2.16 percentage points.

9.3.2 Interest rate, investment and saving

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Econometric studies on investment:

- Fazzari/Mott (1987/88), Fazzari/Hubbard/Petersen (1988), Ndikumana (1999), Gander (2008), Orhangazi (2008a), Argitis/Pitelis (2006), van Treeck (2008), Onaran et al. (2011),
- See also studies discussed in Chapter 7

Hein/Schoder (2011): Germany, US (1960-2007):

- A one percentage point change in the rate of capacity utilization leads to a 0.14 percentage points change in the rate of capital accumulation for the US and to a 0.15 percentage points change for Germany.
- In the US, a one percentage point increase in the profit share raises the rate of accumulation by 0.14 percentage points, whereas in Germany, accumulation increases by 0.33 percentage points.
- In the US a one percentage point increase in the net interest payments-capital stock ratio will lower capital accumulation by 0.72 percentage points, in Germany capital accumulation will decline by 1.03 percentage points.

Econometric estimations of saving functions:

- Onaran/Stockhammer/Grafl (2011), …
- See also studies discussed in Chapter 7

Hein/Schoder (2011): Germany, US (1960-2007):

- In the US the propensity to save out of wages is 0.09 and the propensity to save out of rentiers' income amounts to 0.76,
- The respective values for Germany are 0.13 and 0.6.

9.3.3 Effects of change in the rate of interest on the short-run equilibrium rates of capacity utilization, capital accumulation and profit

Table 9.8 Effects of interest rate variations on the rates of capacity utilization, accumulation, and profit in the US and Germany, 1960 – 2007

	US	Germany
$\frac{\partial u^*}{\partial i}$	-0.47 – 1.49 = -1.96	-1.27 – 0.55 = -1.82
$\frac{\partial g^*}{\partial i}$	-0.17 – 0.15 = -0.32	-0.53 + 0.16 = -0.37
$\frac{\partial r^*}{\partial i}$	-0.10 – 0.03 = -0.13	-0.26 + 0.26 = 0.00
Where		
λ [(a)]	0.15	0.33
h	0.22	0.21
u	0.83	0.53
ι	2.44	2.16
β	0.14	0.15
τ	0.14	0.33
θ	-0.72	-1.03
s_W	0.09	0.13
s_R	0.76	0.60

Notes: λ, h, and u denote the debt-capital ratio, the profit share, and the rate of capacity utilization, respectively, and are average values over the entire time period taken from the statistics. ι, τ, θ, s_W, and s_R are the relevant estimated coefficients from the investment, saving, and profit share function, respectively. The first term in rows 1, 2 and 3 denotes the 'primary effect' of a change in the rate of interest via redistribution between firms and rentiers in each country, and the second term represents 'secondary effect' via redistribution between capital and labour, i.e. between total profits including interest payments and wages. The sum of these effects gives the total effect on the respective equilibrium.

[(a)] Time series from 1965 to 2005 for Germany and from 1960 to 2006 for the US

Source: based on Hein/Schoder (2011, p. 712)

9.4 CONCLUSIONS

- Changes in the monetary rate of interest affect the core functions of the post-Kaleckian model: the distribution function, the saving function and the investment function.
- Depending on the values of these parameters, the effects of interest rate variations on the short-run equilibrium may be either negative throughout (normal case), mixed (intermediate case), or even positive throughout (puzzling case).
- Some evidence of interest rate-elastic mark-ups and profits shares, of significantly different propensities to save from wages and from rentiers' income, and of dampening effects of distributed profits on firms' investment in capital stock for some advanced capitalists economy ➔ normal case.
- Long-run stability of the debt-capital ratio and capital accumulation/growth is associated with the short-run puzzling case and with debt-led accumulation/growth conditions.

- Monetary variables have real effects, both in the short and the long run of the model, which depend on historically, socially and institutionally conditioned parameters in the model.
- Realistic parameter constellations entail a significant instability potential for the financial structure in the long run of the model.
- Possible extensions:

– Include distribution conflict and inflation (Hein 2006c; 2006d; 2008, Chapters 16-17, Hein/Stockhammer 2010; 2011b, …)

– Include shares and dividend payments (Sasaki/Fujita 2012, Hein 2013, …, Chapter 10 of this book)

– Include Minskyan features, i.e. different types of financing behaviour and risk assessments by creditors and debtors, as well as changes over time (Charles 2008a; 2008b; 2008c, Lima/Meirelles 2007, Meirelles/Lima 2006, Nishi 2012, Ryoo 2013, …)