How Economic Policies Profile Industrial Cycles and Long-term Trends (an Application to the USA)

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Contents of this paper

To be in hell is to drift; to be in heaven is to steer.
George Bernard Shaw

Abstract. An upgraded original model of capitalist reproduction (H-2), maintained by the law of surplus value, allows comparing impacts of economic policies on industrial cycles and on long-term trends in the US economy. Inertia scenario I and mobilizing scenario II anticipate regular repetition of over-production and paroxysms. The divergent corporate profits and investment and other puzzles of the base period are clarified.

Internationalized capitalism has been moving to explosion of its contradictions. This social mode of production has been entering a new period of over-production when sound economic policy becomes even more critical.

Based on the US macroeconomic data mainly for 1979–2016, computer simulation runs in Vensim for a later period (through 2031 and beyond) exhibit how policy optimization in 2017 and afterwards could alleviate severity of the next crises and improve long-run performance of the US economy compared to the inertia evolution.

The gates to hell have opened for "Stolt Surf" tanker: “… the waves just grow and grow, it's impossible to stay outside… if we did not manage to keep the diesels running, so that we could control the ship, we would for sure have ended up sideways in the waves.” http://global-mariner.com/index111TheStorm.html Karsten Petersen ©

Unveiling essential contradictions of state-monopoly capitalism

This paper continues a research thread of a class conflict theory of macropolicy based upon the Marxian concept of cycle. The key assumptions are: 1, the contradictions between social character of production and private property, between value and use-value of labour power (its ability to create surplus value) are fundamental factors of capitalist development (including the structural "great recession"); 2, investment are the main trigger mechanism of industrial cycle, 3, capital has been pursuing policies aimed at maximisation of profit that requires the industrial cycle.

Induced technical progress, economy of scale and pro-cyclical character of capital accumulation rate are destabilising factors that prohibit stable equilibrium growth. Sudden changes happen at tipping points reflecting transformation of quantitative changes in qualitative ones.

"Mutations" in productive relations are caused by systemic tensions (contradictions). Policy makers face challenges from social disruptions.

Table 1. The main variables of H-1 and H-2 for the US economy

Real net output NNP P bln \$ 2009 /year
Employment L thousand workers
Labour force N thousand workers
Output per worker $a = P/L$ mln. \$ 2009 /(year* worker)
Employment ratio $v = L/N$ unit fraction
Fixed capital (net) K bln \$ 2009
Labour compensation w mln. \$ 2009 /(year* worker)
Relative labour compensation $u = w/a$ unit fraction
Capital-output ratio $s = K/P$ year
Profit, surplus product $M = (1 - u)P$ bln \$ 2009 /year
Surplus value $S = (1 - u)L$ thousand workers
Accumulation rate k unit fraction
Net accumulation $\dot{K} = kM$ bln \$ 2009 /year
Profit rate (profitability) $M/K = (1 - u)/s$ 1/year
Capital intensity $K/L = sa$ mln \$ 2009 / worker

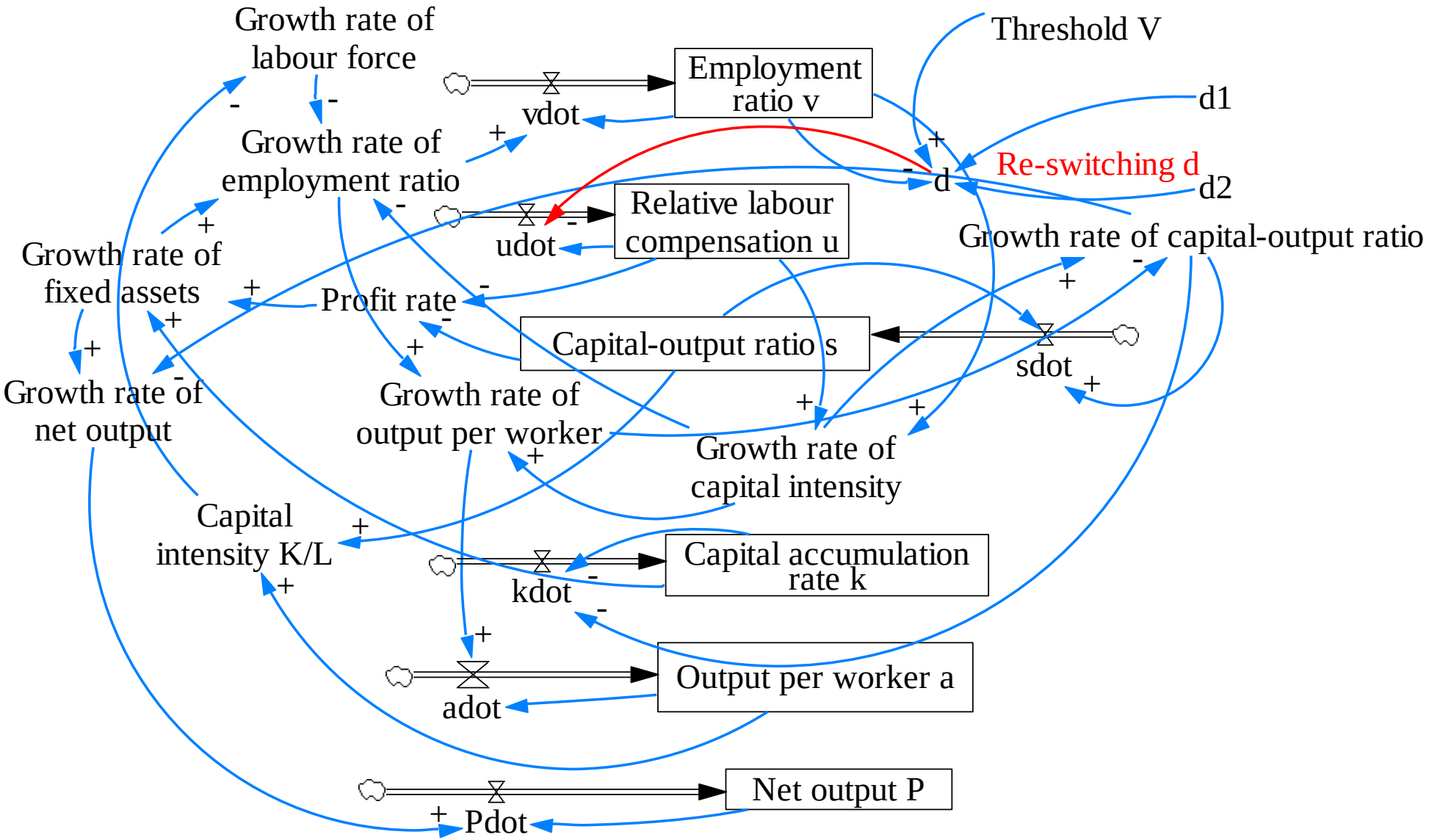
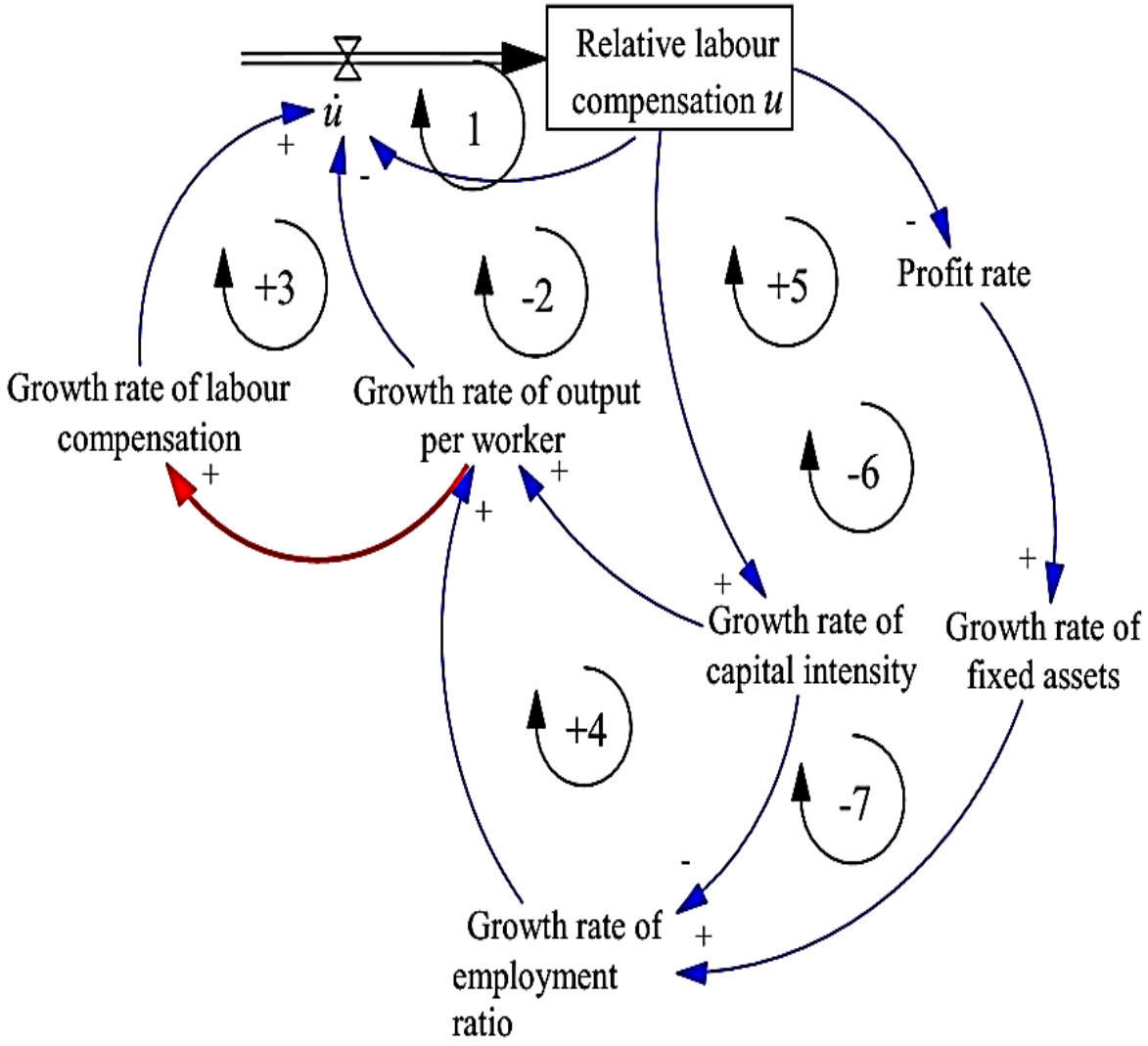


Figure 1 – A condensed causal loop structure of H-1



Growth rate of labour compensation is a piecewise linear function of growth rate of output per worker

$$\hat{w} = \hat{a} - d, \qquad (1)$$

$$d = \begin{cases} d_1 > 0, & v < V \\ d_2 < 0, & v \geq V \end{cases}$$

Whenever employment ratio exceeds threshold $V \approx 0.95$ in boom, re-switching in d takes place: buyers' labour market turns into sellers' labour market.

Figure 2 – The 1st order FB loops of relative labour compensation u in H-1

Equation (2) is an extended technical progress function for growth rate of output per worker. It includes: the rate of change of capital intensity, K/L, and direct positive scale effect, $m_3\psi_1(\hat{v})$

$$\hat{a} = m_1 + m_2\hat{K/L} + m_3\psi_1(\hat{v}), \qquad (2)$$

where $\psi_1(\hat{v}) = sgn(\hat{v})|\hat{v}|^j$, $m_1 > 0$, $1 > m_2 > 0$, $m_3 > 0$, $1 > j > 0$;

Mechanisation (automation) manifests itself in growing capital intensity as the factor of output per worker, on the one hand, and the factor of capital-output ratio, on the other.

A high relative labour compensation and high employment ratio promote mechanization (automation) that shapes the labour supply. The growth rate of capital intensity K/L in (3) is a function of the relative labour compensation u, of the difference between the current employment ratio v and some base magnitude v_c. The latter is parameter in H-1 that becomes a new key variable in (6) in H-2 in conjunction with capital over-accumulation.

$$\hat{K/L} = n_1 + n_2u + n_3(v - v_c), \qquad (3)$$

where $n_1 < 0$, $n_2 > 0$, $n_3 > 0$, $1 > v_c > 0$.

Upgraded model H-2

First, proportional control over capital accumulation rate k is added to derivative control already present in H-1. It utilizes a latent target magnitude of the capital accumulation rate k_{goal}

$$\dot{k} = c_1 \psi_2(\hat{s}) k + c_2 (k_{goal} - k), \tag{4}$$

where $c_1 < 0$, $c_2 = \begin{cases} c_{21} = 0, 1979 \le t < 2008, \\ c_{22} > 0, t \ge 2008, \end{cases}$

$0 < k_{goal} \le 1$, $\psi_2(\hat{s}) = sgn(\hat{s}) |\hat{s}|^{j_2}$, $1 > j_2 > 0$.

Secondly, the positive impact of employment ratio v on the growth rate of the labour force is taken into account

$$n = n_a + p_1 e_2^{-M_2 (K/L - K_c/L_c)^{i2}} + n_5 v \tag{5}$$

for $K/L \ge K_c/L_c$, $e_2 > 0$, $M_2 = 1$, $p_1 > 0$, $n_a < 0$, $n_5 > 0$. In the absence of this cyclic component, $n_{\max} = n_a + p_1$ is achieved at $K/L = K_c/L_c$, there is a monotonic decay of n further for $K/L > K_c/L_c$.

Thirdly, considering absolute over-accumulation of capital, parameter v_c from (3) is transformed into discrete variable

$$v_c = \begin{cases} v_c^{\max}, \text{if surplus value } S_t > S_{t-1}, \\ v_c^{\min}, \text{if surplus value } S_t \le S_{t-1}, \end{cases} . \quad (6)$$

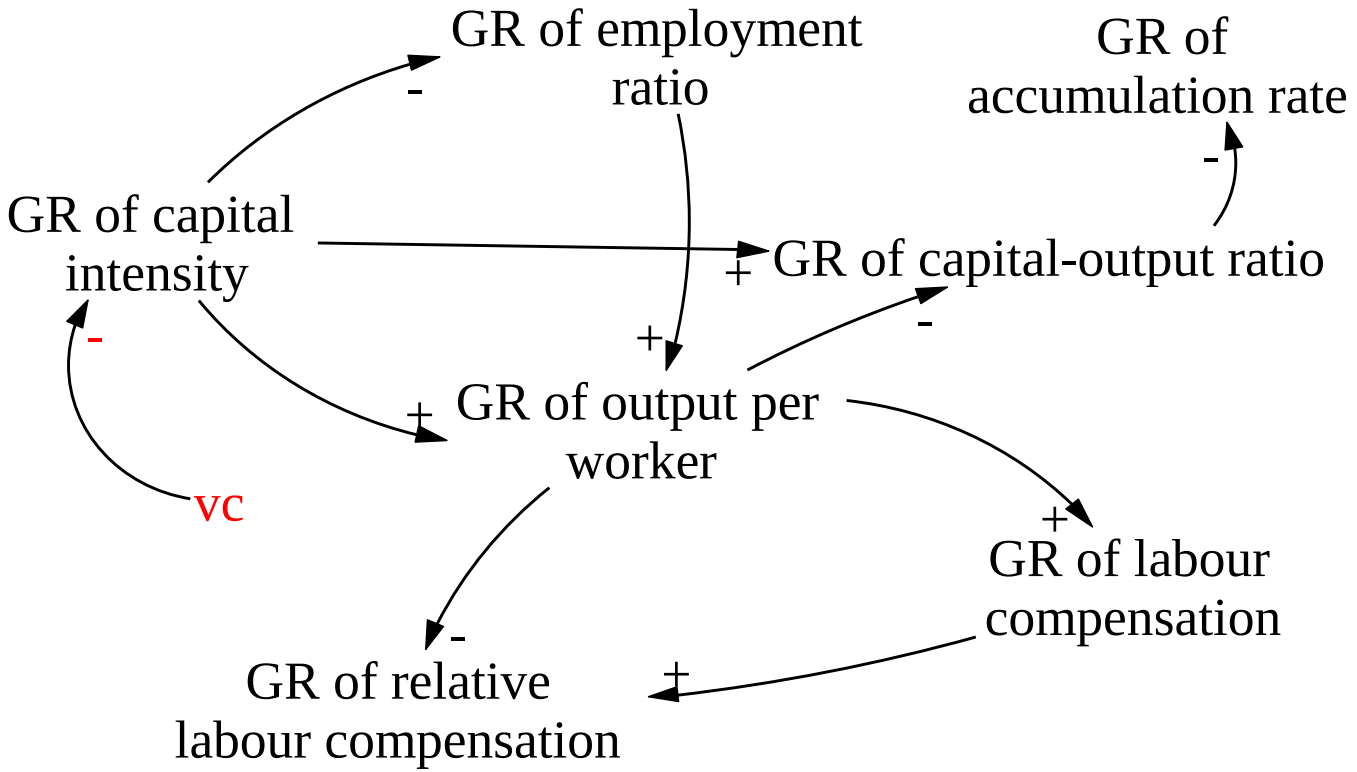


Figure 3 – The direct effects of v_c re-switching in H-2 (GR for growth rate)

The new 2nd order FB loops containing accumulation rate *k* in H-2 (cf. DNA sequencing – determining the precise order of nucleotides)

Positive

$$k \to \hat{K} \to \hat{P} \to \dot{P} \to P \to S \to \delta(S) \to v_c \xrightarrow{-} K\hat{/}L \to \hat{s} \xrightarrow{-} \dot{k}$$

Absolute over-accumulation of capital $\delta(S) = S_t - S_{t-1} \le 0$ fosters growth rates of capital intensity and of capital-output ratio that suppresses net change of accumulation rate and inhibits capital accumulation, so economic growth decelerates thus surplus value plunges and absolute over-accumulation is further worsening. Opposite processes take place when absolute over-accumulation is over.

$$k \to \hat{K} \to \hat{P} \to \dot{P} \to P \to S \to \delta(S) \to v_c \xrightarrow{-} K\hat{/}L \xrightarrow{-} \hat{v} \to \hat{a} \xrightarrow{-} \hat{s} \xrightarrow{-} \dot{k}$$

Negative

$$k \to \hat{K} \to \hat{P} \to \dot{P} \to P \to S \to \delta(S) \to v_c \xrightarrow{-} K\hat{/}L \to \hat{a} \xrightarrow{-} \hat{s} \xrightarrow{-} \dot{k}$$

$$k \to \hat{K} \to \hat{v} \to \hat{a} \to \dot{a} \to a \xrightarrow{-} S \to \delta(S) \to v_c \xrightarrow{-} K\hat{/}L \to \hat{s} \xrightarrow{-} \dot{k}$$

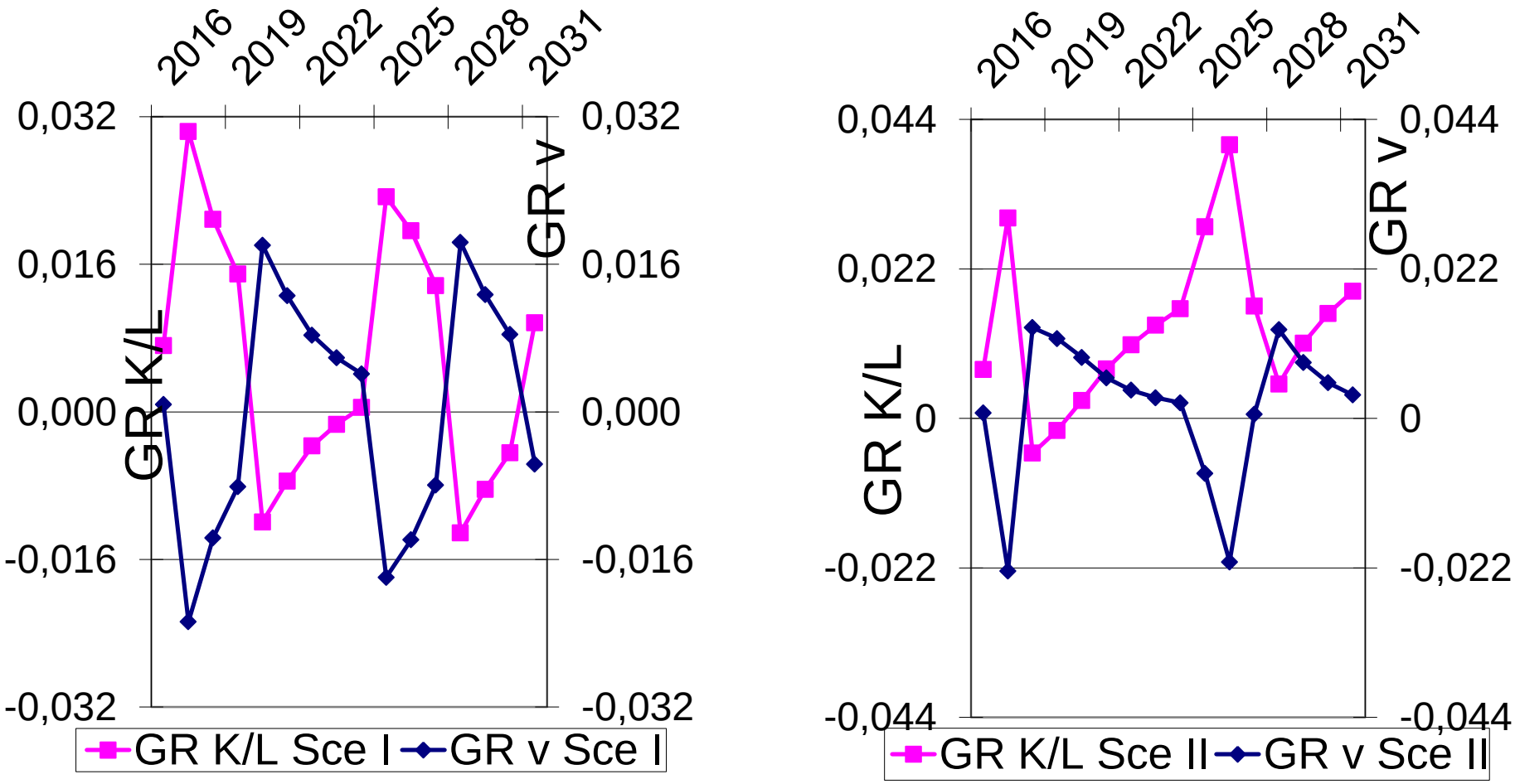


Figure 4 – Growth rate of employment ratio *v* depends negatively on growth rate of capital intensity *K*/*L*, re-switching v_c causes abrupt changes in both GRs, 2016–2031 (scenario I – on the left, scenario II – on the right)

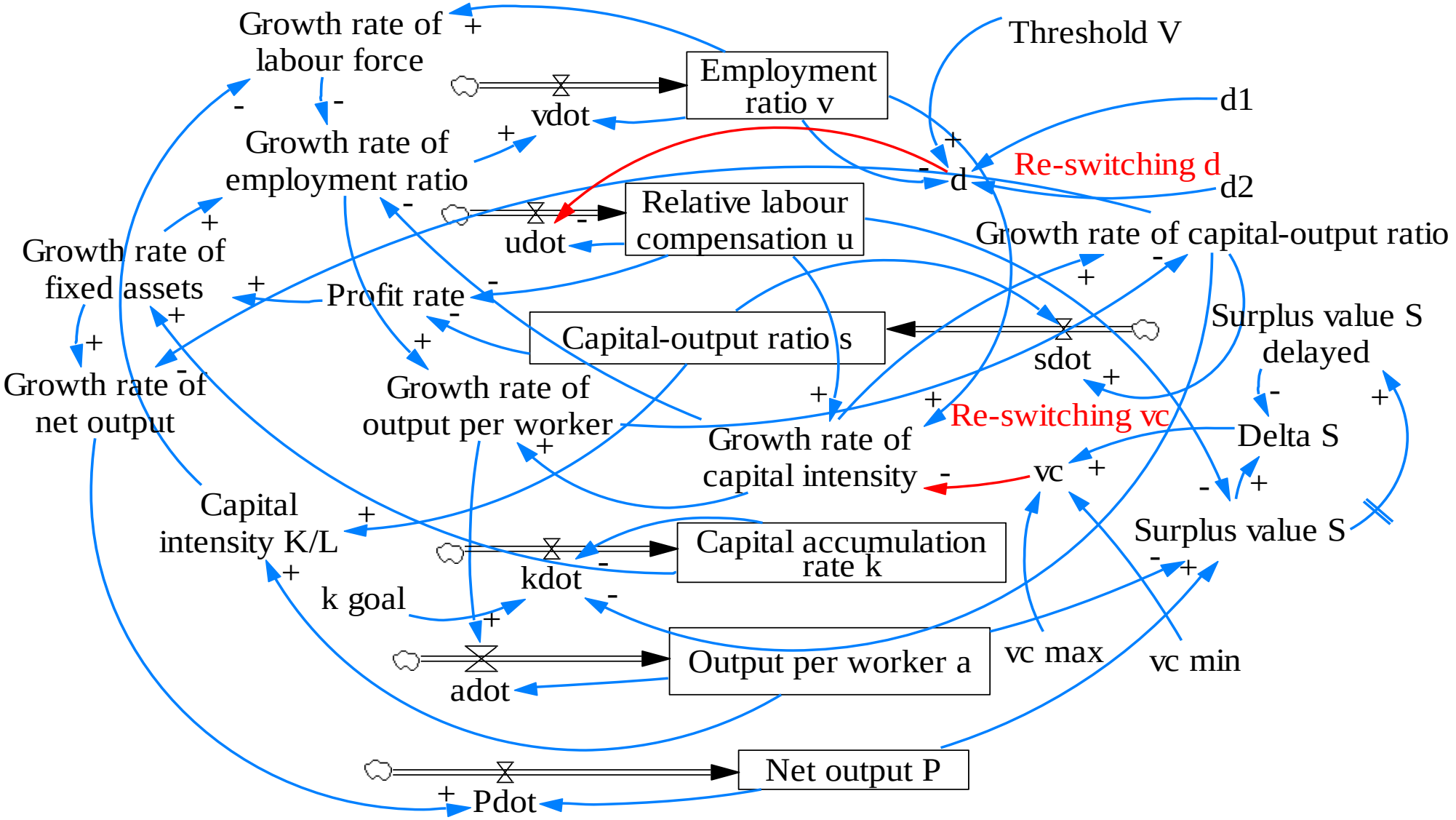
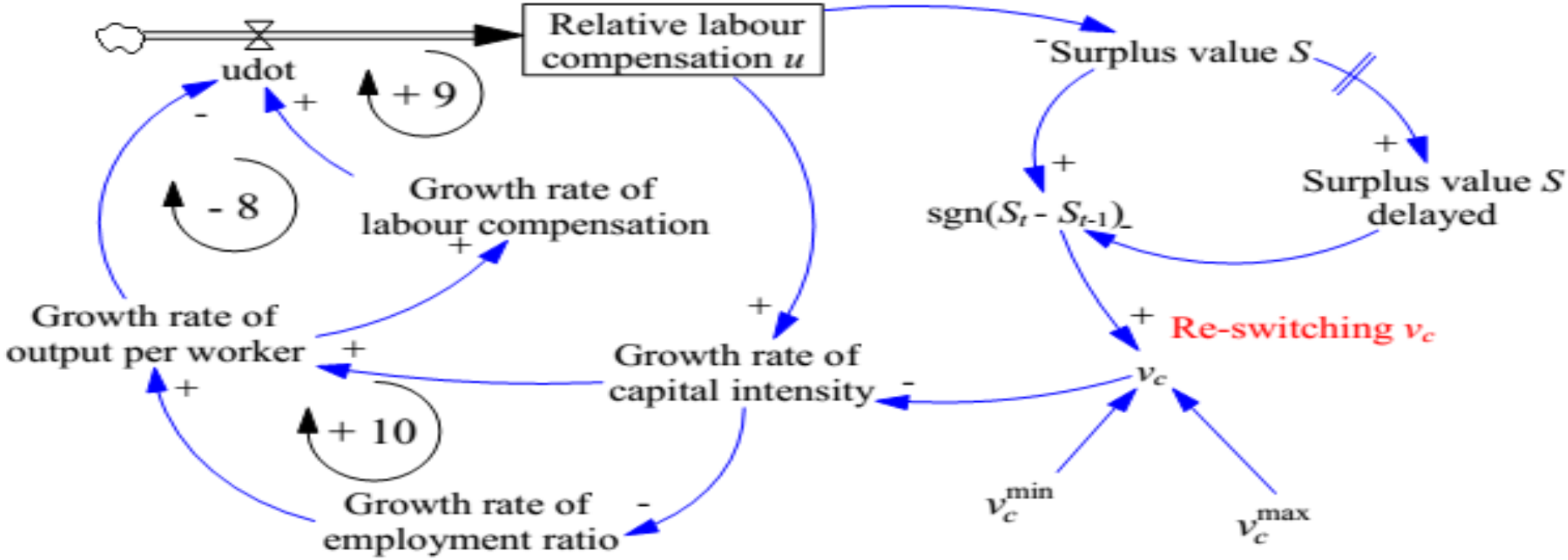


Figure 5 – A condensed causal loop structure of H-2

Delineating causal chains with a precise order of stocks and flows
(cf. determining the precise order of nucleotides within a DNA molecule)



$$-\ 8: u \xrightarrow{-} S \rightarrow \delta(S) \rightarrow v_c \xrightarrow{-} K\hat{/}L \rightarrow \hat{a} \xrightarrow{-} \hat{u} \rightarrow \dot{u}$$

$$+\ 9: u \xrightarrow{-} S \rightarrow \delta(S) \rightarrow v_c \xrightarrow{-} K\hat{/}L \rightarrow \hat{a} \rightarrow \hat{w} \rightarrow \hat{u} \rightarrow \dot{u}$$

$$+\ 10: u \xrightarrow{-} S \rightarrow \delta(S) \rightarrow v_c \xrightarrow{-} K\hat{/}L \xrightarrow{-} \hat{v} \rightarrow \hat{a} \xrightarrow{-} \hat{u} \rightarrow \dot{u}$$

Figure 6 – The three additional 1st order feedback loops containing u in H-2

A simplified version of an extended Kalman filtering (EKF), realised in the Vensim software developed by Ventana Systems, Inc., has been applied. This software enables to estimate the unobservable parameters of H-2 by a procedure of maximum likelihood interwoven with EKF.

Inertia Scenario I – an extrapolation of the retrospective forecast for 2017 and subsequent years, based on H-2 and marked by short-termism.

Profit Enhancing Scenario II (far beyond 2016) maintained by H-2

The integral profit 2016–2057 is maximised subject to restrictions. This payoff takes the magnitude of profit subtracting penalty for excessively high employment ratio that surpasses 0.975. The focus of the current optimisation procedure is on the five parameters that determine secular profit trends and shape transients to regular cycles (Table 2).

$$Maximise\left[\int_{2016}^{2057}[(1-u)P - Penalty\ for\ excessive\ v]dt\right] \qquad (7)$$

subject to $\dot{x} = f_{H-2}[x(t), c_{21}, d_1, d_2, k_{goal}, n_a]$ and to the restrictions on the five parameters in the square brackets (omitted here).

Table 2. Parameters of H-2 identified for 1979–2016 and beyond

Equation	Parameter	Base period and scenario I	Scenario II
1	d_1	0.004	0.0109
1	d_2	–0.0085	–0.0049
4	c_{21}	0 (1979 ≤ t ≤2007) or 0.2 (t ≥ 2008)	0.2
4	k_{goal}	0.03	0.1032
5	n_a	–0.0965	–0.0948

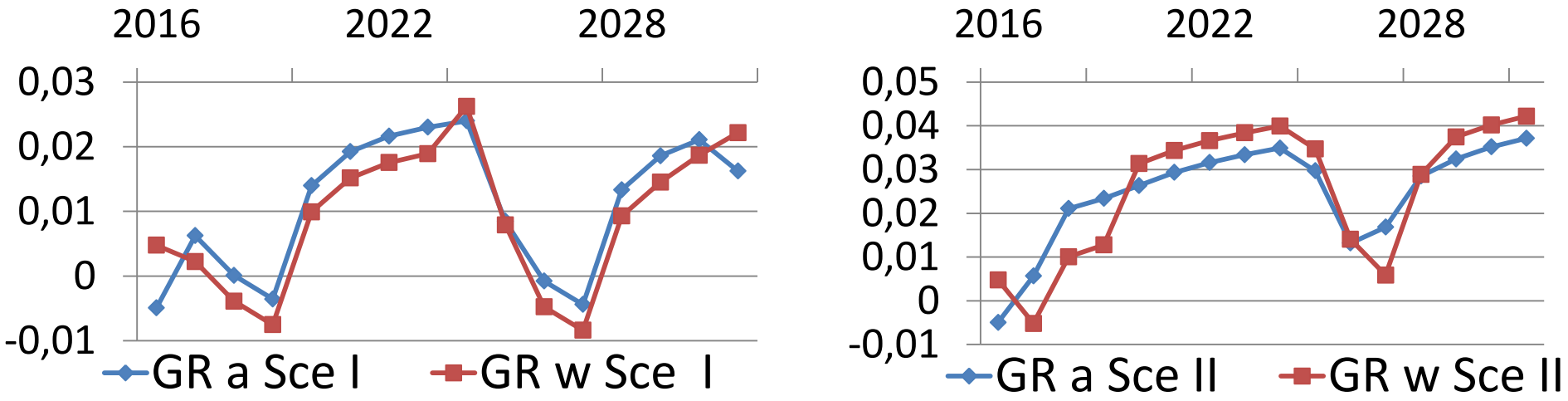


Figure 7 – The growth rates of labour compensation w and of output per worker a, 2016–2031 (scenario I – on the left, scenario II – on the right)

Solving puzzles through behaviour reproduction tests of H-2

Table 3. H-2 simulation errors decomposition, data for US 1979–2016 (3 Q)

Variable	U^M	U^S	U^C (lion share)	$\frac{\sqrt{MSE}}{mean}$, per cent
a	0.000	0.016	0.984	0.01
s	0.009	0.057	0.934	0.2
v	0.056	0.104	0.840	0.2
u	0.049	0.099	0.852	0.5
k	0.003	0.010	0.987	7.2 (max)
$(1-u)/s$	0.022	0.107	0.871	1.2
N	0.002	0.011	0.987	1.3
L	0.006	0.009	0.985	1.3
P	0.010	0.010	0.981	1.3
S	0.003	0.034	0.963	2.1
M	0.000	0.019	0.981	2.1

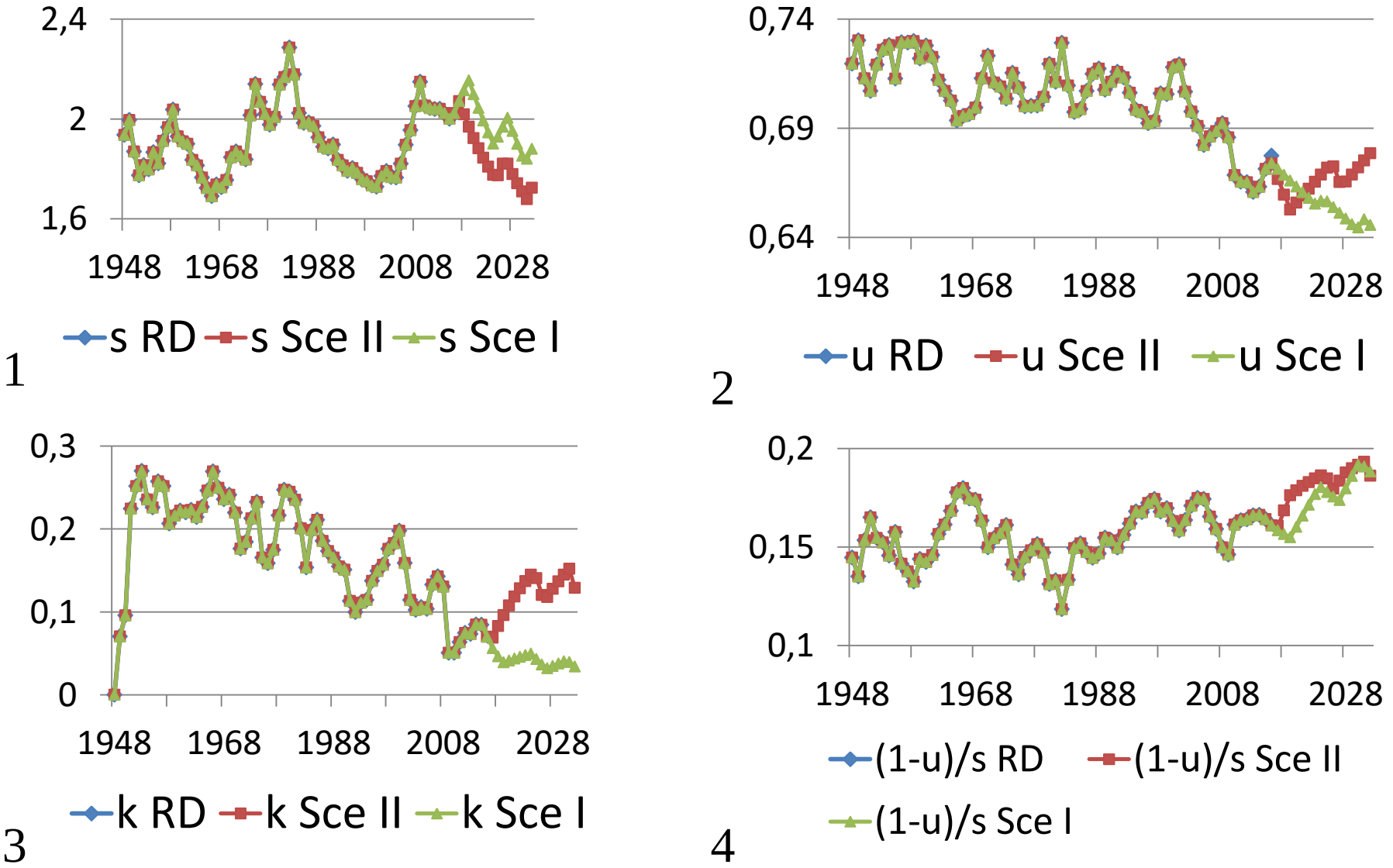


Figure 8 – The observed 1948–2016 and simulated, 1979–2032: 1 – capital-output ratio *s*, 2 – relative labour compensation *u*, 3 – accumulation rate *k*, 4 – profit rate (1– *u*)/*s*

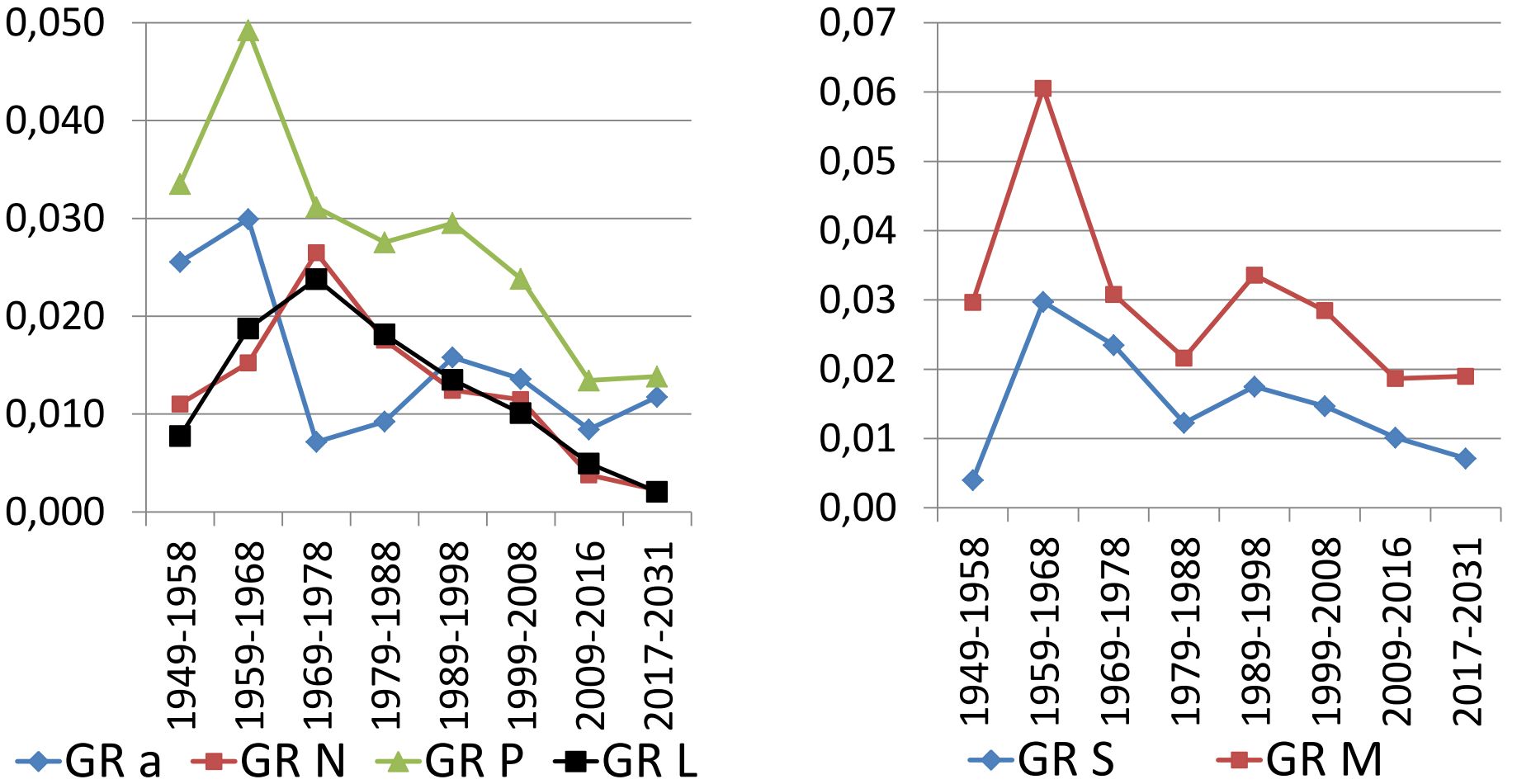


Figure 9 – The dynamics over 1949–2016 and 2017–2031: the tendency to circular stagnation from the base period to scenario I (on the left – the average growth rates of output per worker *a*, NNP *P*, labour force *N* and employment *L*; on the right – the average growth rates of surplus value *S* and profit *M*)

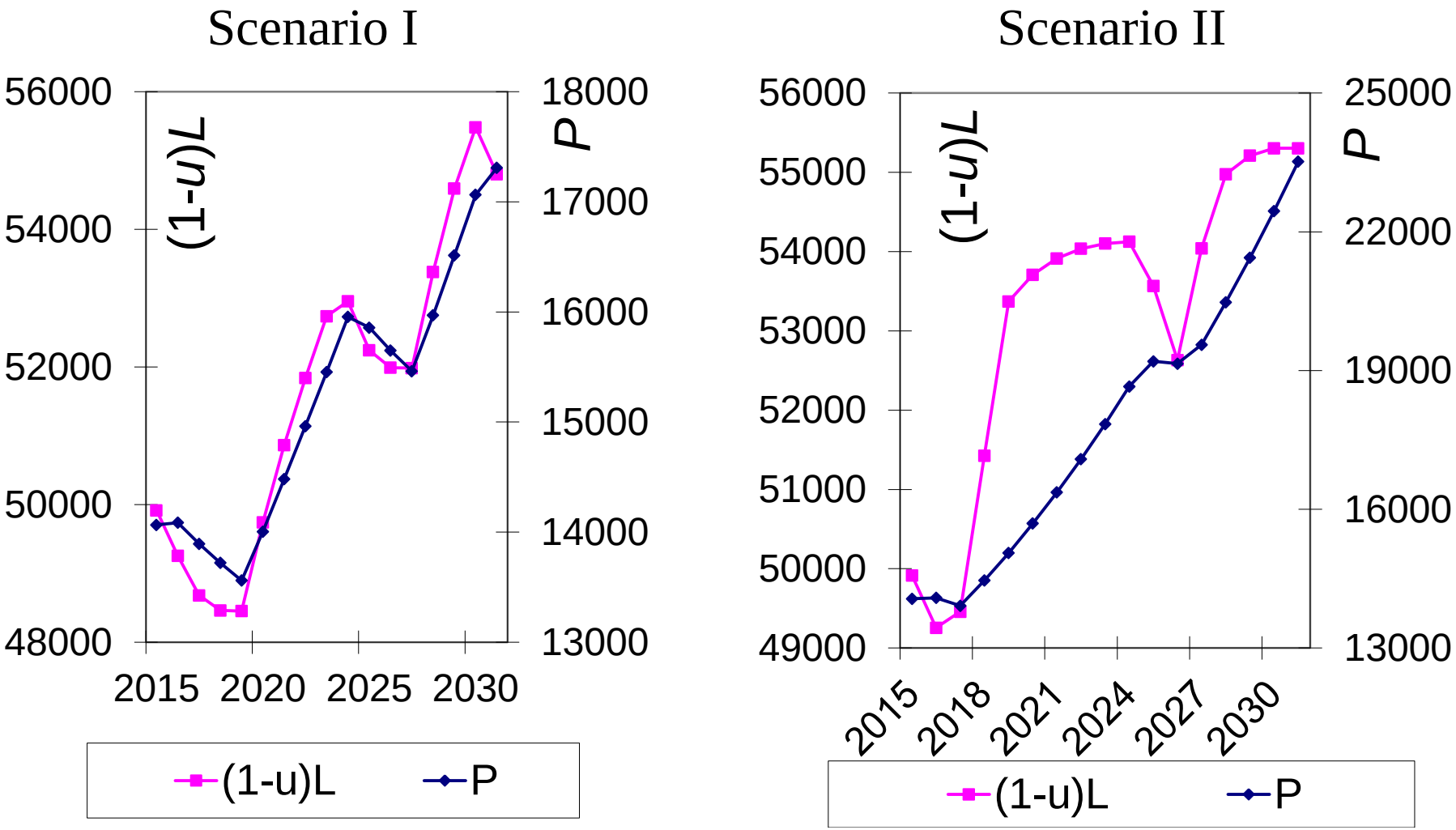
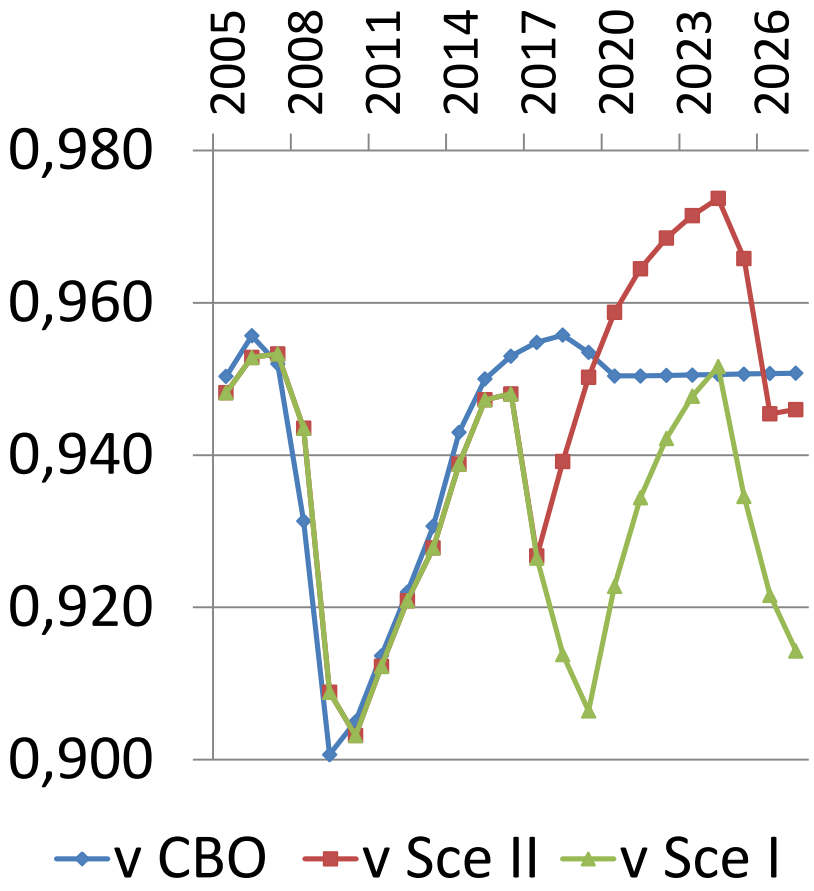


Figure 10 – Surplus value $S = (1–u)L$ and NNP P, 2015–2031

Over-accumulation of K strengthens intra-and inter-class contradictions as well as geopolitical tensions.



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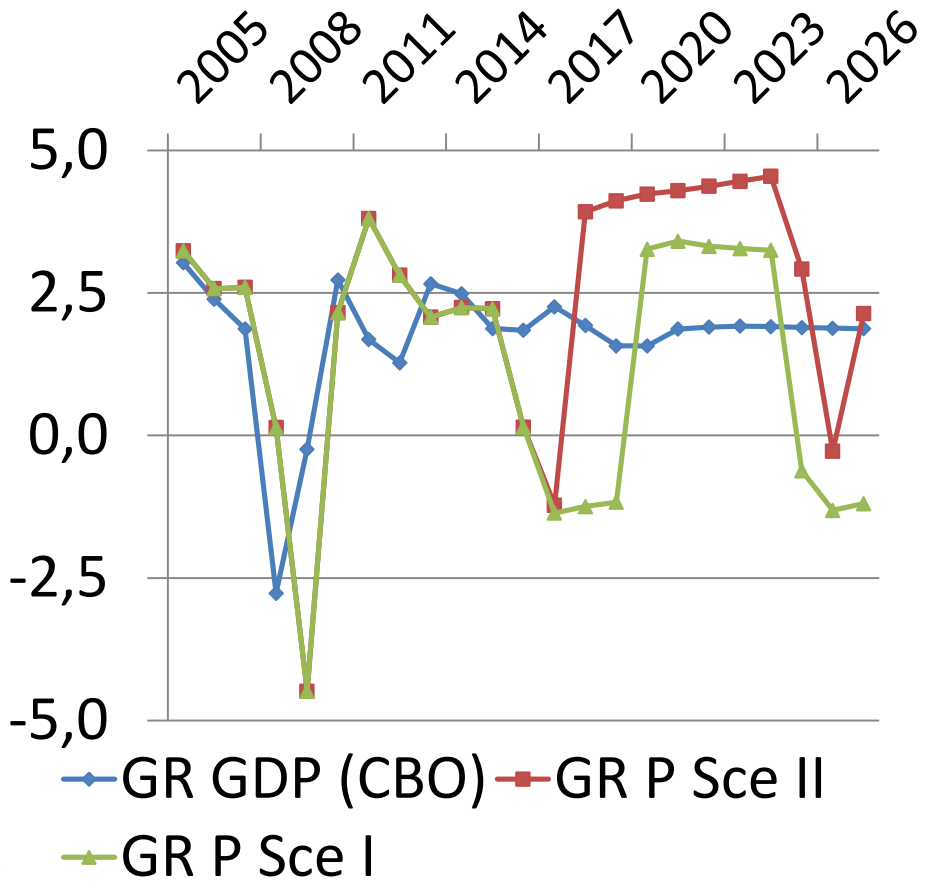

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Figure 11 – Employment ratio *v* on panel 1 and growth rate (GR) of net output (%/year) on panel 2, 2005–2027; triangle – scenario I, square – scenario II, diamond – CBO (January 2017 similar to June 2017)

Table 4. Average geometric growth rates for two adjacent industrial cycles in the scenarios, 2017–2031

Economic indicator	Scenario I			Scenario II		
	cycle 2017–2024	cycle 2025–2031	2 cycles 2017–2031	cycle 2017–2025	cycle 2026–2031	2 cycles 2017–2031
Wage *w*	0.010	0.008	0.009	0.026	0.028	0.027
Consumption a head *vw*	0.010	0.007	0.009	0.028	0.030	0.029
Output per worker *a*	0.013	0.010	0.012	0.026	0.027	0.027
Employment *L*	0.003	0.001	0.002	0.009	0.007	0.008
Labour force *N*	0.002	0.002	0.002	0.007	0.005	0.006
Net output *P*	0.016	0.012	0.014	0.035♠	0.034	0.035
Surplus value *S*	0.009	0.005	0.007	0.009	0.005	0.008
Profit *M*	0.022	0.015	0.019	0.036	0.033	0.035

♠ Cf. the candidate's pledge on 9/15 2016 before his winning of the presidential election.

Conclusion

H-2 reveals that the profit rate, growth rates of output per worker and labour compensation as well as other variables evolve and fluctuate coherently. Their middle-term fluctuations are anharmonic and sensitively bounded.

The dynamics over 1979–2016 are extrapolated in inertia scenario I marked by short-termism; total profit over 2016–2057 is maximized in mobilizing scenario II strategically focused on long term value creation. The policy optimization yields new magnitudes of the five key parameters.

Implementation of scenario II would require against scenario I the substantially increased accumulation rate and raised capital investments, reduced floating, latent and stagnant relative overpopulation (redundant labour force), as well as more deliberately controlled labour compensation. Capitalism would improve its long-term performance if it could get rid of wide-spread (if not prevailing) short-termism in corporate governance.

The projection of endogenous cycles: the 1st 2017–2024, 2nd 2025–2031 in scenario I; the 1st 2017–2025, 2nd 2026–2031 in scenario II. The crisis in the United States, especially in scenario I, will escalate into a world crisis.

The latter will strengthen the first. Still "*you never know who's swimming naked until the tide goes out*" (W. Buffett).

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