Debt-credit flows and stocks in a Supermultiplier model with two autonomous demand components: Consequences for growth

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Introduction 1/2

- The literature on long run growth driven by autonomous demand has been seeing lately intense debates touching upon several points (Serrano et al. 2023). Among the several fields for discussion, two are of interest to our contribution.

- First, the need to incorporate financial elements into this framework. We find the attempts of Pariboni (2016) and Mandarino et al. (2020) to include credit-financed debt demanded by workers. A "monetary theory of demand-led growth" can include this topic (Cesaratto and Di Bucchianico 2020; Cesaratto and Pariboni 2022).

- Second, the quest for solving the issue created by the contemporaneous presence of more than one autonomous component of demand (Allain 2022).

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Introduction 2/2

- In the simple model we will set up, analyse, and simulate, there will be the presence of two autonomous components of demand: workers' credit-financed autonomous consumption and rentiers' consumption out of interest income accruing on accumulated debt.

- It is possible to keep together workers' and rentiers' autonomous consumption in the long-term by relying on the stock-flow connection tying the two. While growth is driven by one component, the other endogenously adjusts to it.

- There is the possibility to solve the 'two-autonomous-components-conundrum' without necessarily imposing peculiar hypotheses on their relative behaviour. Rather, stock-flow relations provide a solution, which can obviously be complemented by institutional elements and political crackdowns.

Related literature 1/4

- Recently, some authors introduced a second autonomous demand component in the supermultiplier model. Allain (2022) raised some important issues in these new formulations, especially for the case where the two components have different growth rates.

- Summing up, there are four approaches to the issue:

1. Assuming that the autonomous components grow at the same rate in the average (Freitas and Christianes 2020);
2. Assuming “institutional elements and deliberate policymaker’s decisions that actively prevent that outcome”, hence exogenous solutions (Morlin 2022; Dvoskin & Landau 2023);
3. Assuming that the convergence results from the SFC restrictions (Woodgate et al. 2023; Di Bucchianico et al. 2024);
4. Assuming that the behaviors of the two components adjust to each other endogenously (Allain).

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Related literature – Strategy 1 - 2/4

- Freitas and Christianes (2020) present a supermultiplier model for the analysis of government fiscal policy and debt in closed economies. They introduce two sources of autonomous demand: capitalists' autonomous consumption and government consumption.

- Again, they assume that "the rates of growth of the two autonomous demand components are related in a way that, although they can be different, there is a tendency for them to be equal on average over time", but they do not propose a mechanism that can justify the adjustment of growth rates.

- Pedrosa, Brochier and Freitas (2023) use two sources of debt-financed autonomous demand (government and household consumption), and they assume "the same average autonomous demand growth rate in the long run", without justifying this specific assumption.

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Related literature – Strategy 2 - 3/4

- Morlin (2022) focuses on a model with government spending and exports considering the dynamics of the external constraint. The first adjustment mechanism is needed when excessive growth of government spending, relative to that of exports, may lead to balance of payments stability problems. The growth rate of government spending must converge to the lower growth rate of exports.

- Alternatively, the government could implement industrial policies that would improve the elasticities of exports to income and decrease those of imports, generating a permanent increase in the growth rate of exports. This would reduce the foreign constraint and increase fiscal space.

- A supermultiplier model applied to the open economy is also that of Dvoskin and Torchinsky Landau (2023). The equality of the growth rates of the autonomous components in the long run is assumed.

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Related literature – Strategy 3 - 4/4

- Hein and Woodgate (2021) have both interest payments on government debt and consumption out of wealth and they show how it is possible, under certain assumptions, to align the growth rates of multiple autonomous components.

- Di Bucchianico (2021) sets up a supermultiplier model with workers' autonomous credit-financed consumption and capitalists' autonomous consumption out of interest income accruing from accumulated debt. The former sets the pace of autonomous demand expansion.

- Woodgate, Hein and Summa (2023) construct a supermultiplier model in which increases in deficit-financed government spending result in an interest flow to rentiers. The growth rate of the latter component must adjust to that of the former.

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The model 1/10

- Grounding on Freitas and Serrano (2015), Serrano and Freitas (2017), we start from a closed economy without a government and an external sector. There is a one fixed-coefficients technique and only one product is produced combining homogeneous labour with homogeneous fixed capital.

- Natural resources and labour are overabundant, constant returns to scale, income distribution fixed exogenously. All variables are expressed in real terms and the price level does not change. Full capacity output Y_{Kt} depends on the capital-to-capacity-output ratio v and the capital stock K_t.

- The fundamental driver is parameter α, representing workers trying to preserve consumption standards (Barba and Pivetti 2009), and/or the willingness to pursue consumption standards set by richer households, aka 'keeping up with the Joneses' (Setterfield and Kim 2016).

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The model 2/10

Consumption

$$C = C^w + C^\pi = C^c + c_w[s_w Y - (i + \varphi)D_w] + c_\pi(iD_w + s_\pi Y)$$

Investment

$$I = hY$$

Autonomous demand

$$Z = C^c - [c_w(i + \varphi) + c_\pi i]D_w$$

Equilibrium level of output

$$Y^* = \frac{Z}{1 - [(c_w s_w + c_\pi s_\pi) + h]} = \frac{Z}{s - h}$$

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The model 3/10

Rate of change of autonomous demand

$$\dot{Z} = \dot{C}^c - [c_w(i + \varphi) + c_\pi i]\dot{D}_w$$

Rate of change of workers' aut. consumption

$$\dot{C}^c = (\alpha - \beta i)C^c$$

Rate of change of workers' debt

$$\dot{D}_w = C^c - \varphi D_w$$

The model 4/10

Rearranging autonomous demand

$$Z = D_w(d-q), \qquad d = {C^c}/{D_w}, \qquad q = c_w(i+\varphi) - c_\pi i$$

Growth rate of autonomous demand

$$g_z = g_{D_w} + g_{d-q} = (d-\varphi) + \frac{d(\alpha - \beta i - d + \varphi)}{d-q}$$

Separating the two terms

$$g_{D_w} = \frac{C^c - \varphi D_w}{D_w} = d - \varphi \qquad g_{d-q} = \frac{\dot{(d-q)}}{d-q} = \frac{d(\alpha - \beta i - d + \varphi)}{d-q}$$

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The model 5/10

- Given that the economy is supposed to grow at a pace g_Z set by autonomous demand in the long-run steady state, and that autonomous demand in our case is composed by two elements, we must isolate the dominant component.

- Pariboni (2016, pp. 227) points out that "the economy's growth rate slowly converges to the growth rate of the fastest growing autonomous component". We exploit this clue by finding a condition according to which one component sets the growth rate of autonomous demand.

$$g_{zw} \gtreqless g_{z\pi} \rightarrow (\alpha - \beta i)d - c_w(i + \varphi)(d - \varphi) \gtreqless c_\pi i(d - \varphi)$$

$$\alpha \gtreqless (1 - \theta)[c_w(i + \varphi) + c_\pi i] + \beta i, \qquad \theta = {}^{\varphi}/_{d}$$

The model 6/10

Marginal propensity to invest

$$\dot{h} = h\gamma(u - u_n)$$

Rate of capacity utilization

$$\dot{u} = u\left(g_Z + \frac{h\gamma(u - u_n)}{1 - [(c_w s_w + c_\pi s_\pi) + h]} - \frac{h}{v}u + \delta\right) =$$

$$= u\left((d - \varphi) + \frac{d(\alpha - \beta i - d + \varphi)}{d - q} + \frac{h\gamma(u - u_n)}{1 - [(c_w s_w + c_\pi s_\pi) + h]} - \frac{h}{v}u + \delta\right)$$

Private debt

$$\dot{d} = d[\alpha - \beta i - d + \varphi]$$

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The model 7/10

To check for stability, we proceed to derive the Jacobian for the three-equation system and then we evaluate it at the steady-state by means of the solutions.

$$J = \begin{pmatrix} \frac{\partial \dot{u}}{\partial u} & \frac{\partial \dot{u}}{\partial h} & \frac{\partial \dot{u}}{\partial d} \\ \frac{\partial \dot{h}}{\partial u} & \frac{\partial \dot{h}}{\partial h} & \frac{\partial \dot{h}}{\partial d} \\ \frac{\partial \dot{d}}{\partial u} & \frac{\partial \dot{d}}{\partial h} & \frac{\partial \dot{d}}{\partial d} \end{pmatrix} \rightarrow$$

$$J_{u^*,h^*,d^*} = \begin{pmatrix} (\alpha - \beta i + \delta)\left(\frac{v\gamma}{s - \left[(\alpha - \beta i + \delta)\frac{v}{u_n}\right]} - 1\right) & -\frac{u_n^2}{v} & -\frac{u_n q}{\alpha - \beta i + \varphi - q} \\ (\alpha - \beta i + \delta)\frac{v\gamma}{u_n} & 0 & 0 \\ 0 & 0 & -(\alpha - \beta i + \varphi) \end{pmatrix}$$

The model 8/10

Routh-Hurwitz conditions

1. $Det(J^*) < 0$
2. $Tr(J^*) < 0$
3. $-Tr(J^*)[Det(J_1^*) + Det(J_2^*) + Det(J_3^*)] + Det(J^*) > 0$

Stability condition 1

$$\alpha > \beta i$$

Stability condition 2

$$\frac{\gamma}{s - (\alpha - \beta i + \delta)\frac{v}{u_n}} < \frac{1}{v}$$

The model – SFC 9/10

	Workers	Rentiers	Firms	Banks	Sum
Deposits	D^{w}_{ep}	D^{π}_{ep}		$-(D^{w}_{ep} + D^{\pi}_{ep})$	0
Loans	$-D^{w}$			D^{w}	0
Capital			K		K
Equity		E	$-E$		0
Net worth	$D^{w}_{ep} - D^{w}$	$D^{\pi}_{ep} + E$	$K - E$	$D^{w} - (D^{w}_{ep} + D^{\pi}_{ep})$	K

Balance sheet matrix

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The model - SFC 10/10

Transaction flow matrix

	Workers	Rentiers	Firms		Banks		SUM
			Current	Capital	Current	Capital	
Consumption	$-C^w$	$-C^\pi$	$C^w + C^\pi$				0
Wages	W^w		$-W^w$				0
Investment			I	$-I$			0
Profits		$\Pi + [iD^w - i_d(D^w_{ep} + D^\pi_{ep})]$	$-\Pi$		$-[iD^w - i_d(D^w_{ep} + D^\pi_{ep})]$		0
Loan flow	$C^c - \phi D^w$					$-C^c + \phi D^w$	0
Loan interest	$-iD^w$				iD^w		0
Deposit flow	$-\Delta D^w_{ep}$	$-\Delta D^\pi_{ep}$				$\Delta D^w_{ep} + \Delta D^\pi_{ep}$	0
Deposit interest	$i_d D^w_{ep}$	$i_d D^\pi_{ep}$			$-i_d(D^w_{ep} + D^\pi_{ep})$		0
Equity issues		$-\Delta E$		ΔE			0
Sum	0	0	0	0	0	0	

Simulation 1/8

- Parameter values are set in accordance with the empirical evidence for the US. The model is calibrated at an annual frequency. The calibration exercise is purely illustrative in nature, as proper evaluation of the model would require further empirical and econometric investigation.

- The initial condition for the credit-financed consumption-to-debt ratio (d_0) is set to be 1% above its steady-state value, in a similar fashion to the growth rate of autonomous demand (set to be $g_{z,0} = g_Z^* + 0.01 = .029 \ + .01 = 3.9\%$).

- This set of initial conditions represents a situation where the economy is experiencing a credit-fuelled injection of purchasing power, that raises at the same time the credit-financed consumption-to-debt ratio and the growth rate of autonomous demand.

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Simulation – Initial conditions 2/8

Par.	Description	Value	Source
π	Profit share	0.39	Authors' calculation, based on AMECO (2023)
c_w	Propensity to consume out of wages	0.7	Authors' calculation, based on Fazzari, Ferri, and Variato (2020)
c_π	Propensity to consume out of profits	0.2	Authors' calculation, based on Fazzari, Ferri, and Variato (2020)
u_n	Normal rate of capacity utilization	0.8242	Setterfield and Budd (2011), Gallo (2022b)
v	Capital-capacity ratio (annual)	0.989	Gallo (2022b), Fazzari, Ferri, and Variato (2020)

Parameter calibration

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Simulation – Initial conditions 3/8

Par.	Description	Value	Source
δ	Depreciation rate (annual)	0.084	Fazzari et al. (2020)
i	Federal funds rate	0.01 (0.02)	Authors' calculation, based on FRED (2023)
γ	Sensitivity of the investment share to $u_t - u_n$	0.15	Nomaler et al (2021), Gallo (2022b)
α	Incompressible credit-financed consumption growth	0.03 (0.035)	Authors' calculation, moments to match
β	Sensitivity of credit-financed consumption to i	0.1	Authors' calculation, moments to match
φ	Amortization rate	0.01	Svensson (2016)

Parameter calibration (continued)

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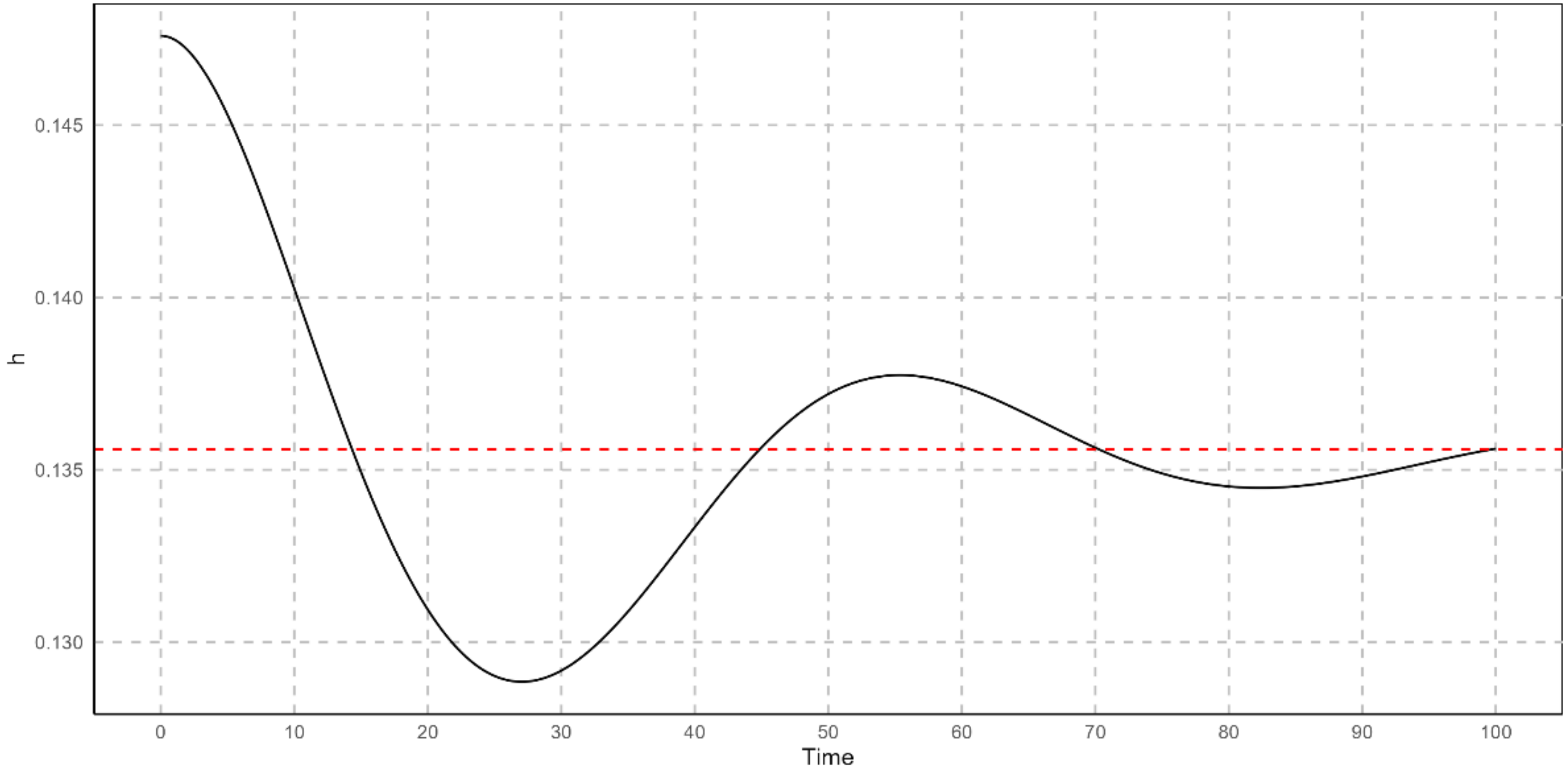
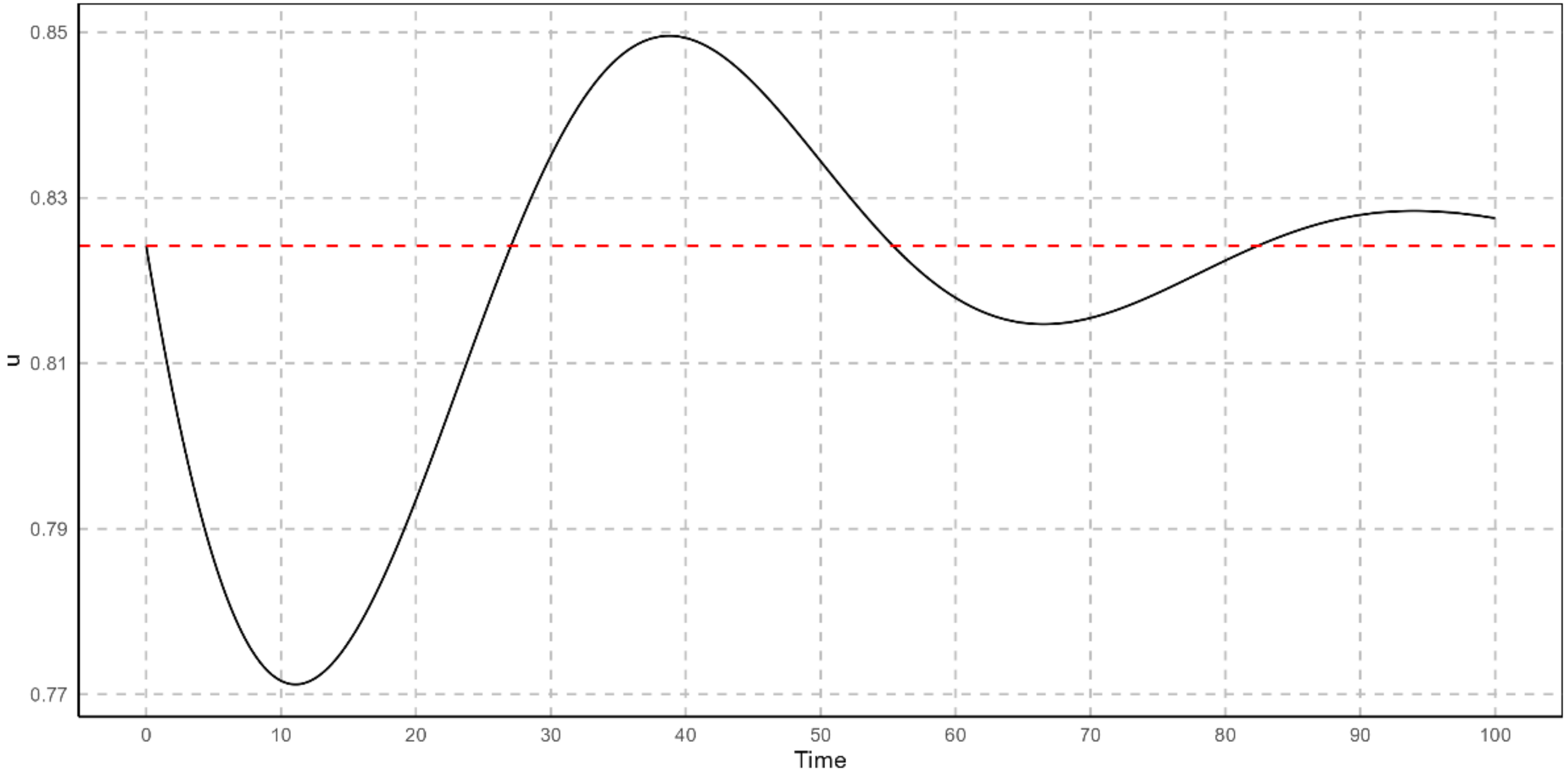
Simulation 4/8



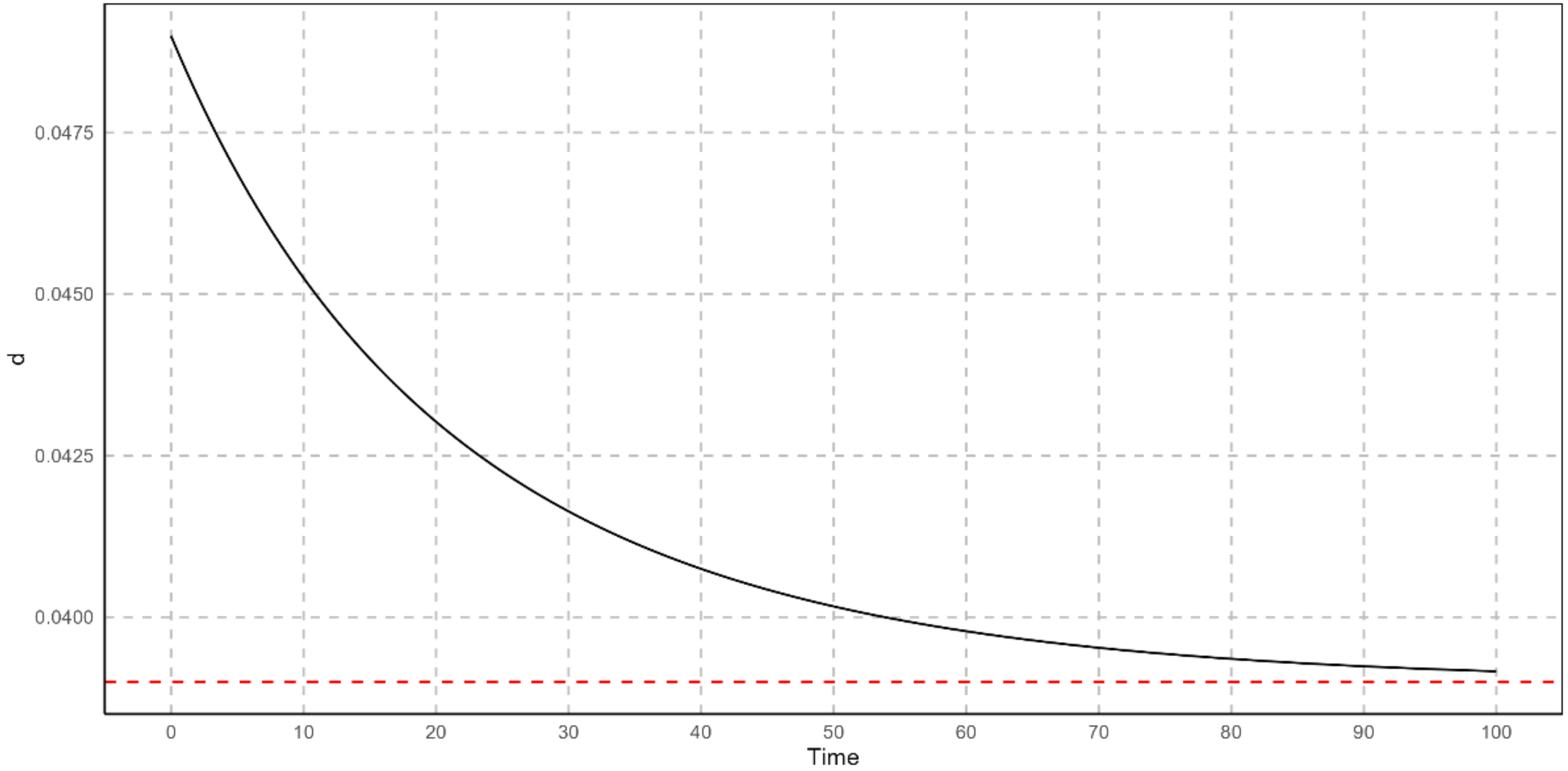
The model’s long-run traverse (marginal propensity to invest).

Simulation 5/8



The model’s long-run traverse (rate of capacity utilization).

Simulation 6/8



The model’s long-run traverse (credit-financed consumption-to-private debt ratio).

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Simulation 7/8

- The simulations confirm the slow pace of convergence to the fully-adjusted position in the supermultiplier model. Supermultiplier models of both Sraffian and Kaleckian fashion ought to be interpreted as ‘traverse models’; disequilibrium is the norm (Gallo and Setterfield 2023).

- Since the investment share at $t = 0$ is above its long-run equilibrium, capacity utilization will initially decrease. The damped cycles in the capacity utilization rate and in the investment share will last up until the steady-state position corresponding to a higher level of autonomous demand is achieved.

- Summarizing, a credit-financed consumption shock has long-lasting effects on growth and credit-debt relations, supporting the idea of the interrelation of growth and finance widespread in the post-Keynesian – and particularly Minskyan literature.

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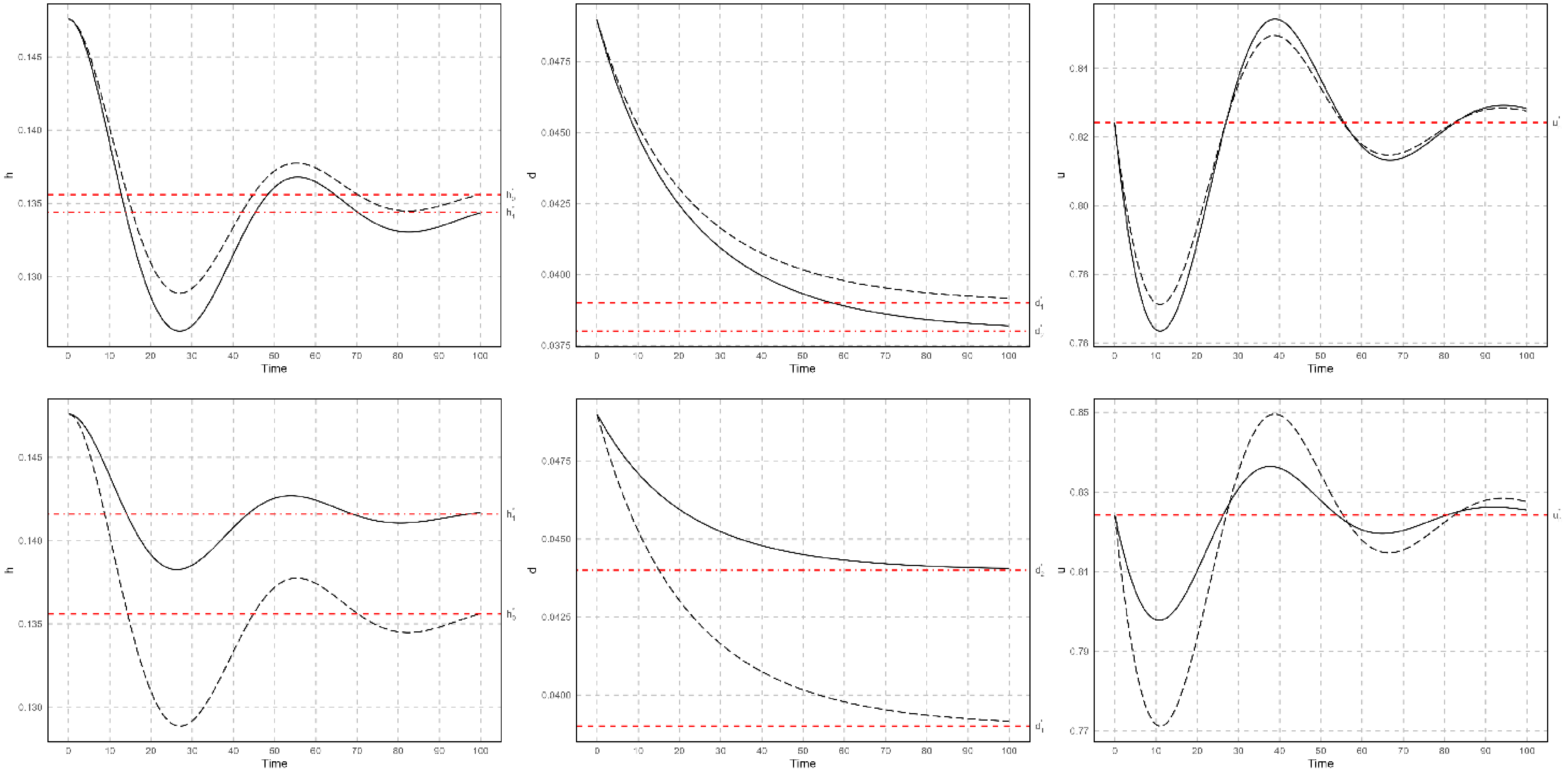
Simulation - Robustness 8/8



Top panel: robustness with a changing interest rate. **Bottom panel**: robustness with a changing alpha.

Conclusions 1/2

- We tackle the need to incorporate financial elements into the Supermultiplier and to solve the steady-state puzzle posed by the presence of more than one autonomous demand component prominently feature current debates.

- We built a simple model in which workers accumulate private debt in the hands of rentiers to sustain spending through credit-financed consumption. In turn, rentiers' autonomous consumption is fed by interest flows accruing from accumulating debt.

- It is possible to keep together workers' autonomous credit-financed consumption and rentiers' autonomous consumption in the long-term by simply relying on the stock-flow connection tying the two.

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Conclusions 2/2

- The stability of the long-run equilibrium as well as the traverse path of the model has been studied by numerically solving the nonlinear system of differential equations underlying the model's adjustment process. Calibration using empirical evidence for the US and past studies.

- In line with other supermultiplier models, our system is also characterized by a slow pace of adjustment to the long-run fully adjusted position. Changes in credit-debt relations affect the model by affecting autonomous demand growth, thus having growth effects both during and after the traverse.

- In conclusion, stock-flow relations can provide a purely economic solution to the 'two-autonomous-components-conundrum'. Further research is needed to uncover additional avenues of application for this principle, as well as to integrate it with institutional elements as well as political crackdowns.

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Thank you for your attention!

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