



Bulgarian National Bank
EUROPEAN SYSTEM OF CENTRAL BANKS

Banks Paying for Banks: A Dynamic General Equilibrium Perspective

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*The opinions expressed are those of the author and do not necessarily reflect the official views
of the Bulgarian National Bank and the European System of Central Banks.*

Realisations from recent financial and economic crisis

- Financial intermediaries critical for economic growth and transmission of policies: monetary (price) stability; financial stability; fiscal policies.
- Financial markets can become source of systemic disturbance producing negative externalities to wider economy.
- Immediate response to recent financial and economic crisis: monetary and fiscal policies.
- Diagnoses. Institutional reforms and proposals.

New policy issues

- Need to evaluate impact of new policies and institutional reforms in short- and long-term taking into account feedback effects.
- Endogenous liquidity and bank recapitalisations: impact on inflation, real economy, incl. consumption and saving choices.
- Ex-ante risk, uncertainty and default.
- Bail-outs. Bail-ins. Moral hazard. Ex-ante incentives.
- Burden-sharing. Public finance issues.

Proposed framework for macroeconomic analysis

- Dynamic general equilibrium: spillovers and feedback loops between various economic agents and institutions, i.e. borrowers and savers, banks and the state, consumers and producers.
- Micro-found macro literature under incorporates incomplete information, financial markets' imperfections and endogenous default inside the equilibrium fundamentals, such as Greenwald and Stiglitz (1987, 1990, 1993a and 1993b), Gatti and Galegati (1996 and 1997).
- Financial intermediation, incomplete markets and endogenous default in a finite horizon optimisation setting – Tsomocos (1993), Tsomocos and Zicchino (2005), Goodhart et al. (2005 and 2006) and Tsenova (2013a and 2013b).
- Evidence for information imperfections, imperfect foresight and learning – Orphanides and Williams (2008) and Tsenova (2012).
- Literature on incentives and moral hazard under uncertainty and financing constraints – Goldfeld and Quandt (1988 and 1992), Dewatripont and Maskin (1995) and Kornai (1992).

Proposed framework for macroeconomic analysis

Economic activity – Firms

$$\pi_{t+1}^i = \theta_{t+1}^i f(x_t^i) - (1 + i_t) \frac{P_t}{P_{t+1}} b_t^i$$

$$\pi_{t+1}^i = \theta_{t+1}^i f(x_t^i) - (1 + i_t) \frac{P_t}{P_{t+1}} (w_t x_t^i - a_t^i)$$

Bankruptcy threshold

$$\hat{\theta}_{t+1} = (1 + i_t) \frac{P_t}{P_{t+1}} \frac{(w_t x_t - a_t)}{f(x_t)}$$

Proposed framework for macroeconomic analysis

Economic activity – Firms' profit maximisation:

$$E[\pi_{t+1}] = f(x_t) - (1 + i_t) \frac{P_t}{P_{t+1}^e} (w_t x_t - a_t) \\ - f(x_t) s \int_0^{\hat{\theta}_{t+1}} \theta g(\theta) d\theta + (1 + i_t) \frac{P_t}{P_{t+1}^e} (w_t x_t - a_t) s \int_0^{\hat{\theta}_{t+1}} g(\theta) d\theta$$

FOC:

$$\frac{d}{dx_t} f(x_t) = (1 + i_t) \frac{P_t}{P_{t+1}^e} w_t \left(\frac{1 - s \int_0^{\hat{\theta}_{t+1}^e} g(\theta) d\theta}{1 - s \int_0^{\hat{\theta}_{t+1}^e} \theta g(\theta) d\theta} \right)$$

Proposed framework for macroeconomic analysis

Financial intermediation – banks:

$$\begin{aligned}
 E[1 + \rho_t] &= (1 + i_t) \left(1 - \int_0^{\hat{\theta}_{t+1}^e} g(\theta) d\theta + s \int_0^{\hat{\theta}_{t+1}^e} g(\theta) d\theta \right) \\
 &\quad + (1 - s) \frac{P_{t+1}^e}{P_t} \frac{f(x_t)}{(\bar{w}x_t - a_t)} \int_0^{\hat{\theta}_{t+1}^e} \theta g(\theta) d\theta \\
 i_t &= \frac{(1 - s) \int_0^{\hat{\theta}_t} (\hat{\theta}_t - \theta) g(\theta) d\theta}{\hat{\theta}_{t+1}^e - (1 - s) \int_0^{\hat{\theta}_t} (\hat{\theta}_t - \theta) g(\theta) d\theta}
 \end{aligned} \tag{1}$$

Proposed framework for macroeconomic analysis

Households, money demand and supply:

$$\begin{aligned} \max \sum_{t=t_0}^{\infty} \beta^{t-t_0} [c_t + v(m_t)] \\ \text{s.t. } c_t = \bar{w}x_t + T_t - m_t + \frac{P_{t-1}}{P_t}m_{t-1} \\ \frac{M_t^d - M_{t-1}^d}{P_t} = m_t - \frac{P_{t-1}}{P_t}m_{t-1} \\ v'(m_t) = 1 - \beta\varphi_{t+1}^e \end{aligned}$$

General equilibrium condition:

$$c_t = f(x_{t-1})$$

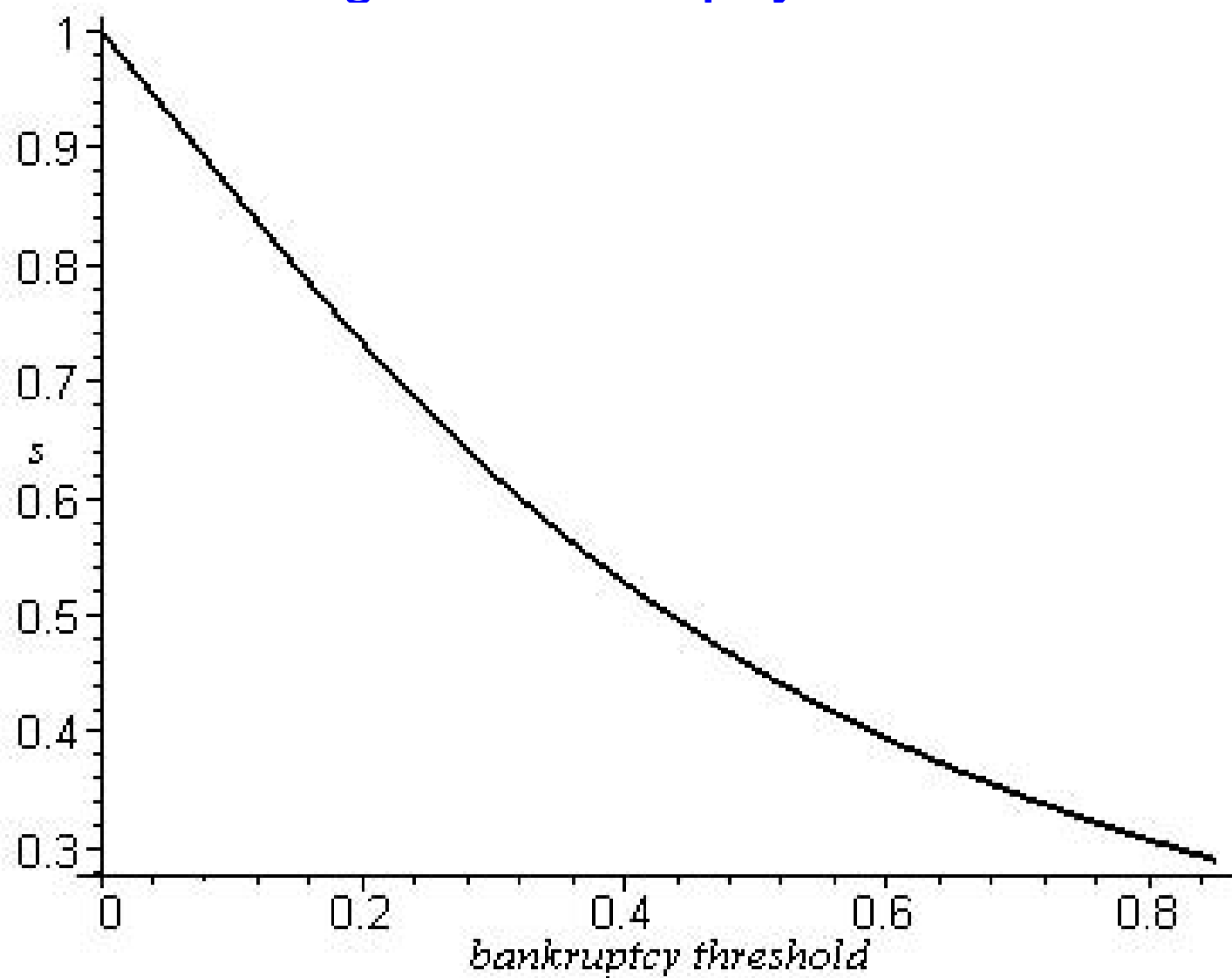
Proposed framework for macroeconomic analysis

Financial asset - accumulated business profits

$$A_t = E [A_t^i] = E [p_t^i] f(x_{t-1}) - (1 + i_{t-1}) P_{t-1} (\bar{w} x_{t-1} - a_{t-1}) + (M_t - M_{t-1}) - T_t P_t$$
$$E [p_t^i] = P_t$$

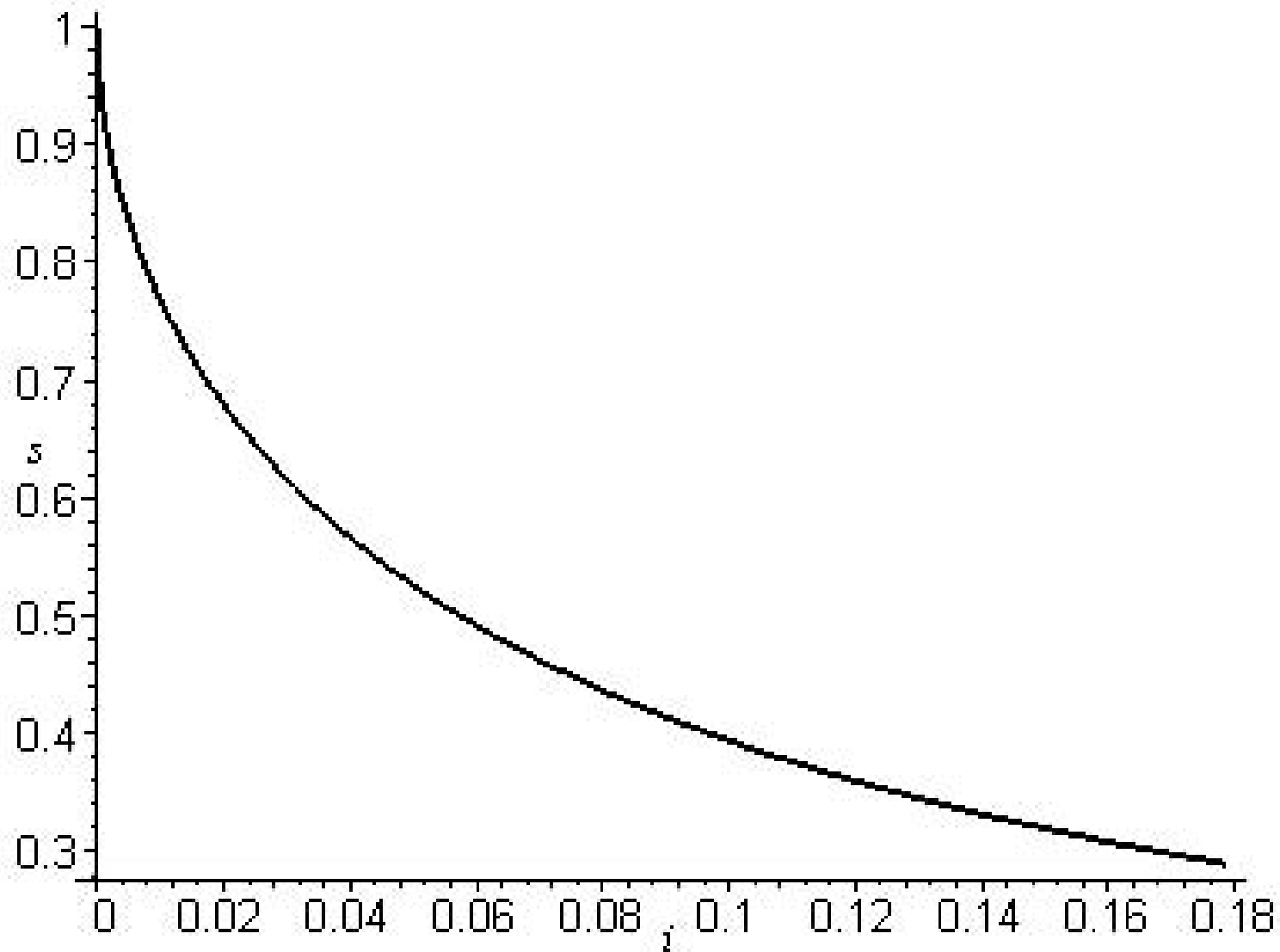
$$a_t = (1 - \tau_t) f(x_{t-1}) \left(1 - \hat{\theta}_t + s \int_0^{\hat{\theta}_t} (\hat{\theta}_t - \theta) g(\theta) d\theta \right) \quad (2)$$

Longer-term bankruptcy threshold



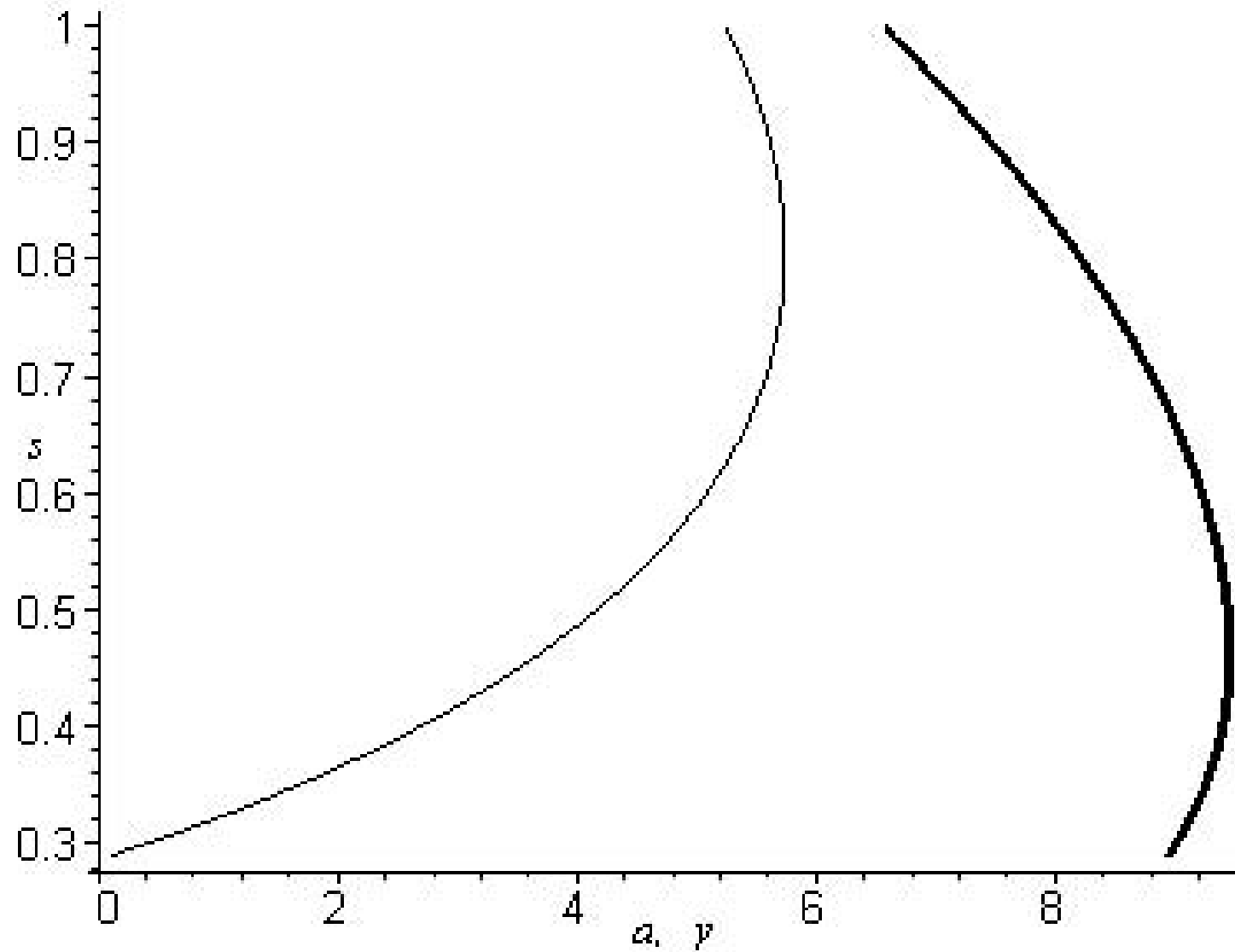
Note: Steady states for the full range of degrees of financial softness

Longer-term inflation rate, interest rate and money growth rate



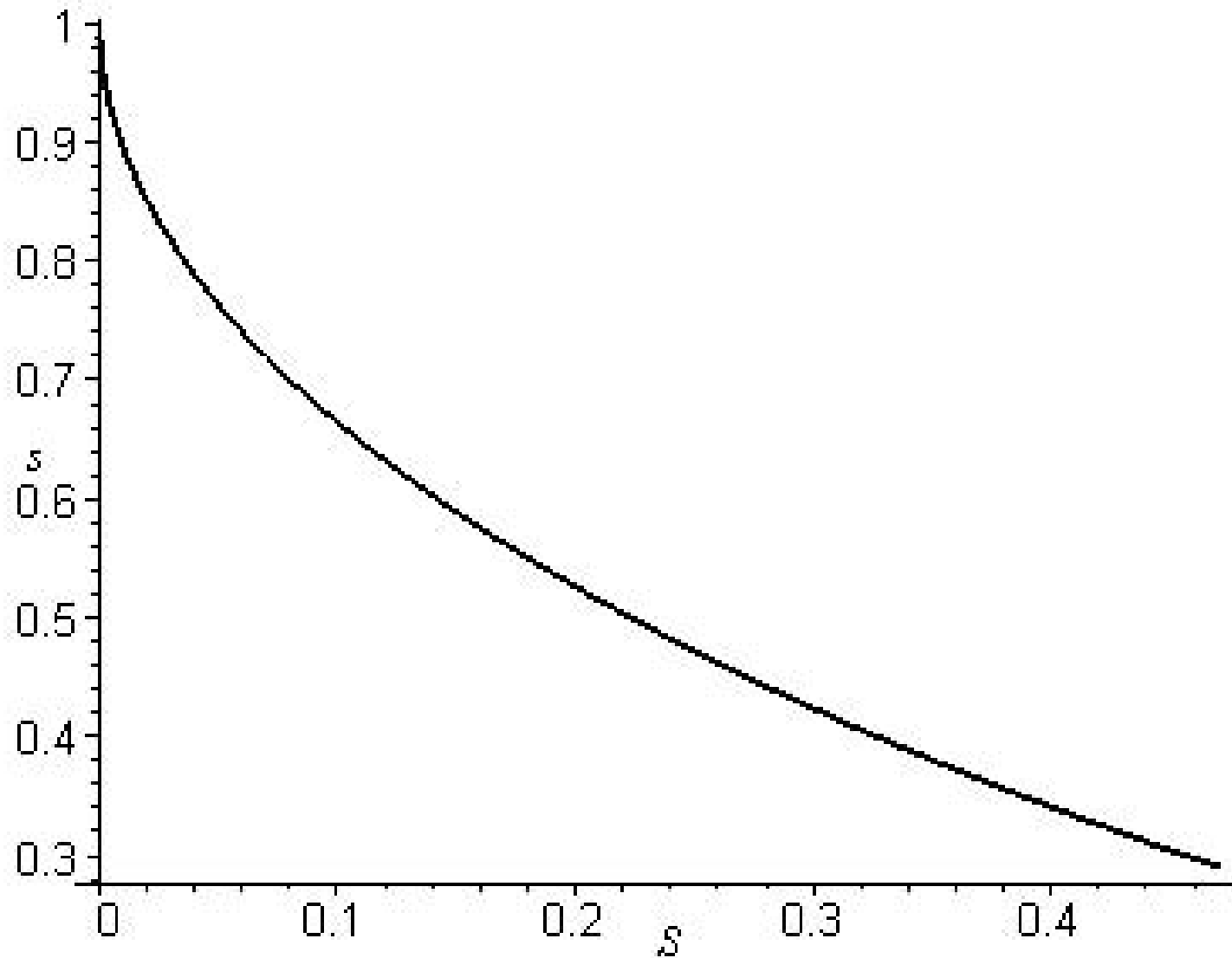
Note: Steady states for the full range of degrees of financial softness

Longer-term output and aggregate asset



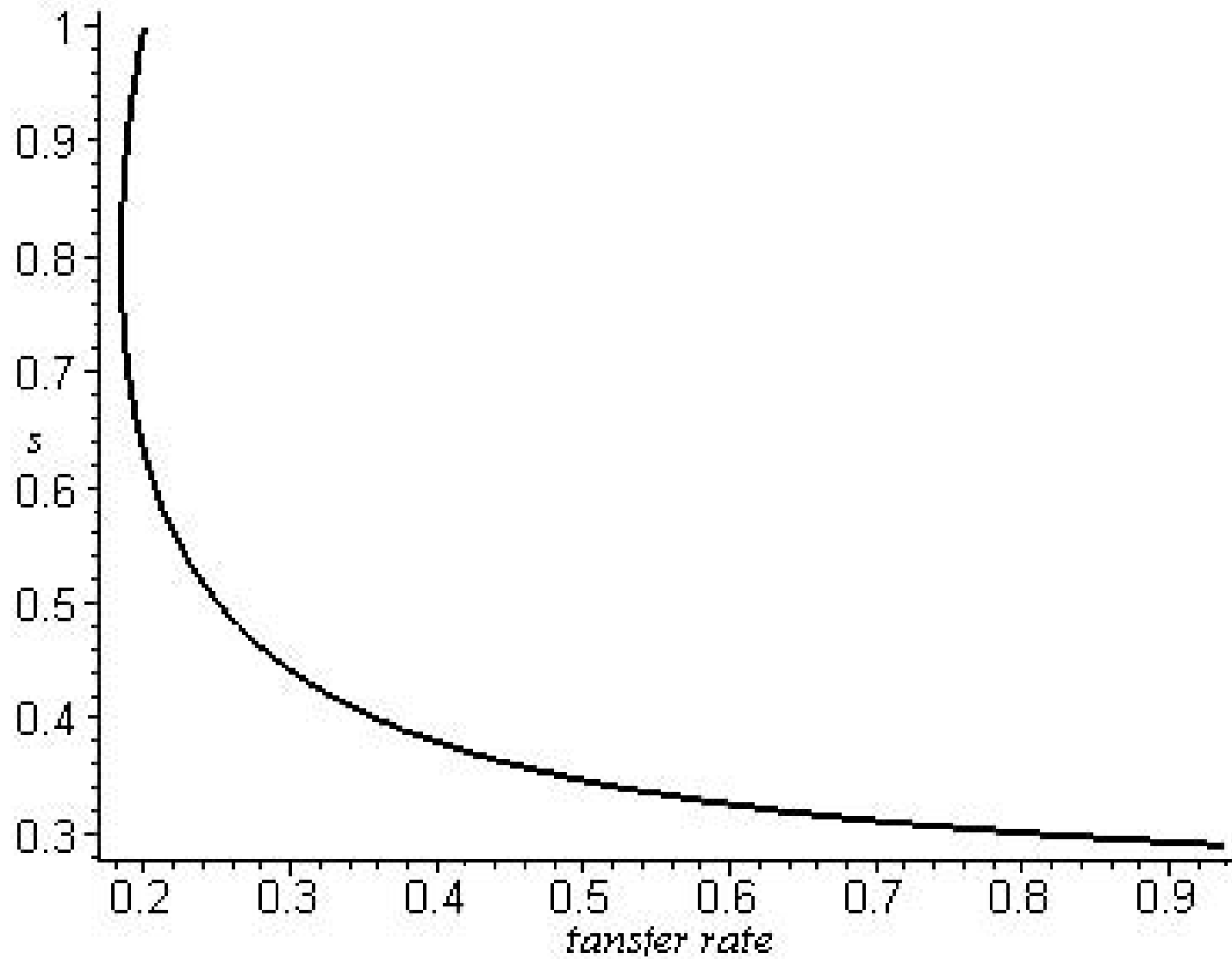
Note: Steady states for the full range of degrees of financial softness

Longer-term bail-out subsidies



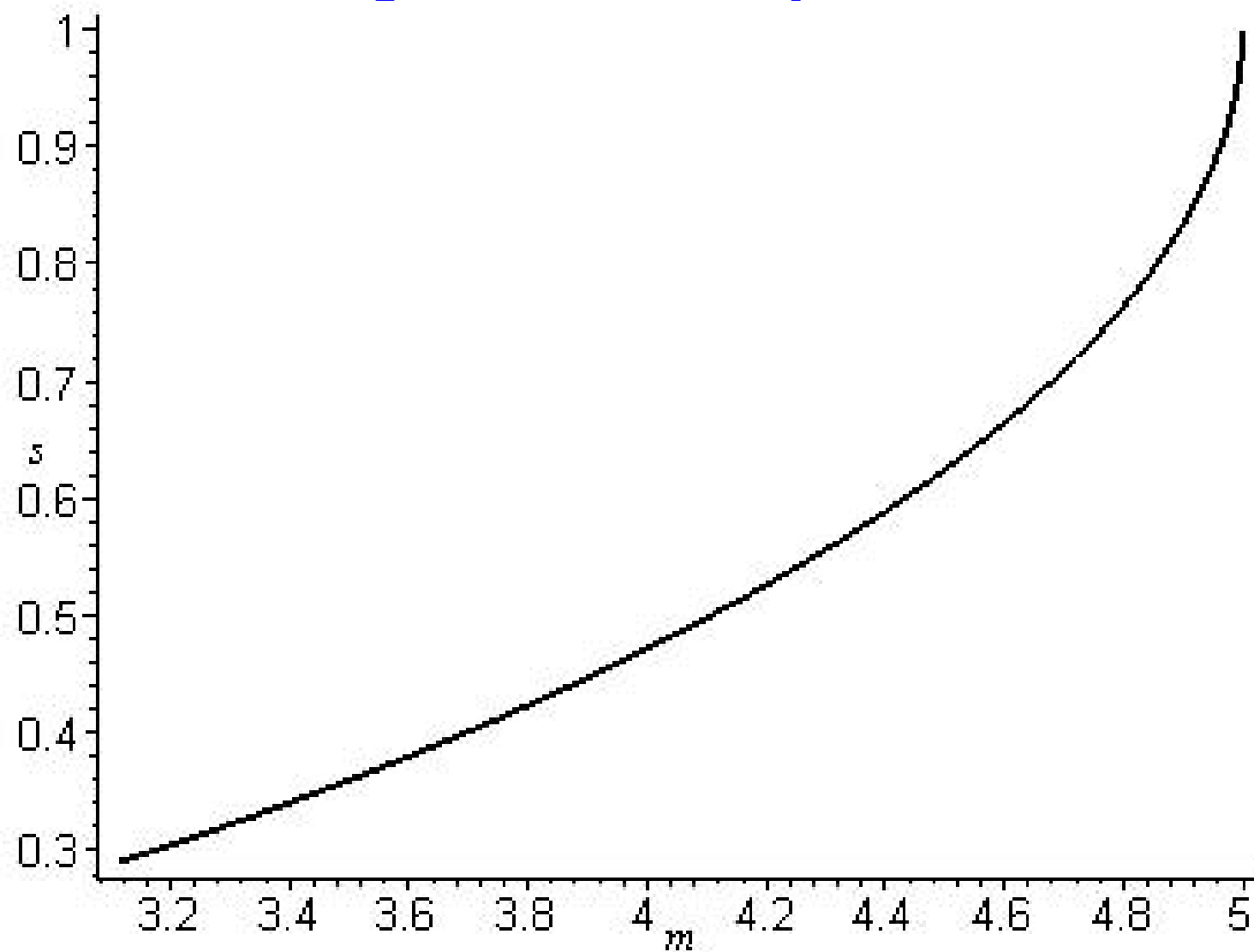
Note: Steady states for the full range of degrees of financial softness

Longer-term bail-in levy rate



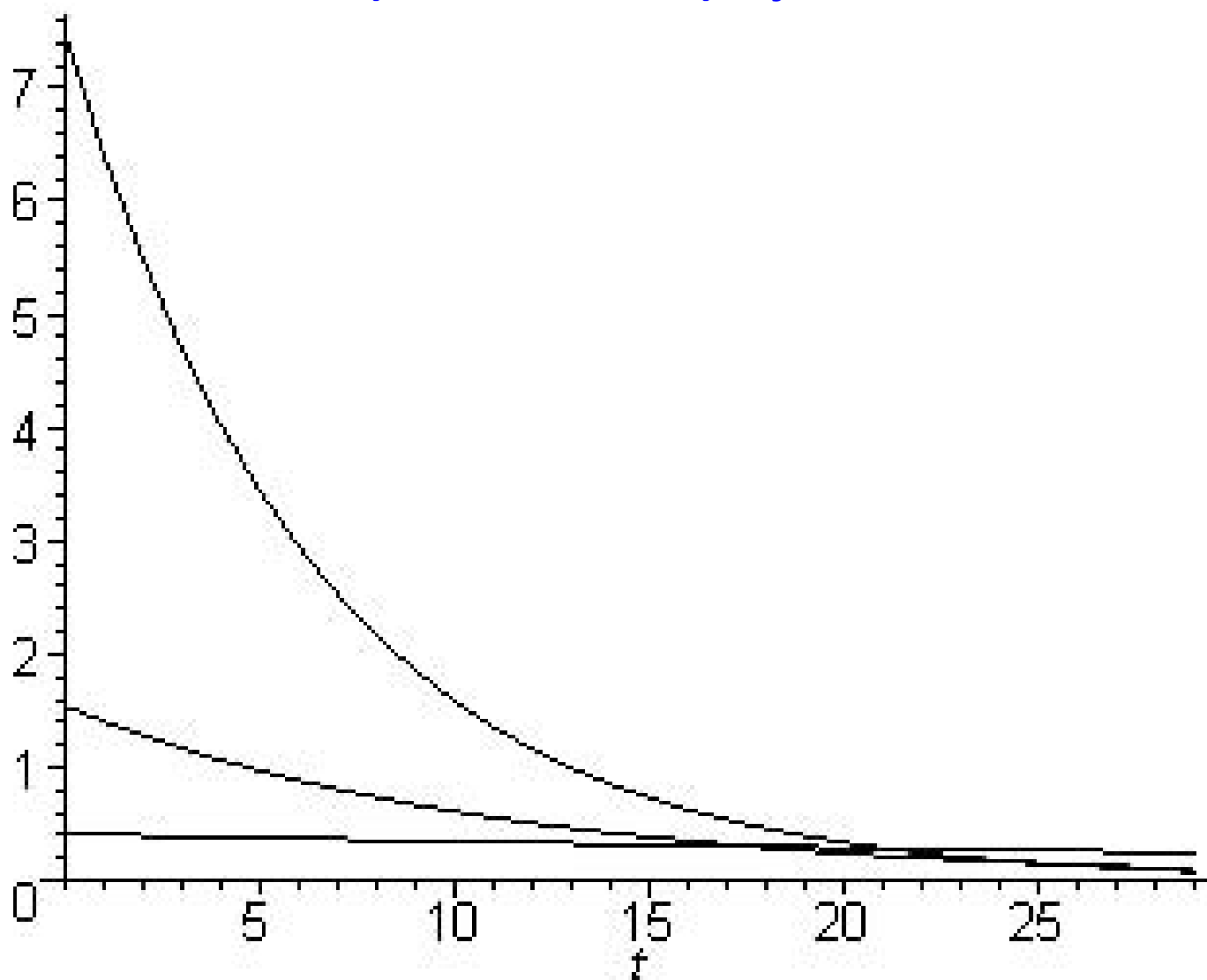
Note: Steady states for the full range of degrees of financial softness

Longer-term real money balances



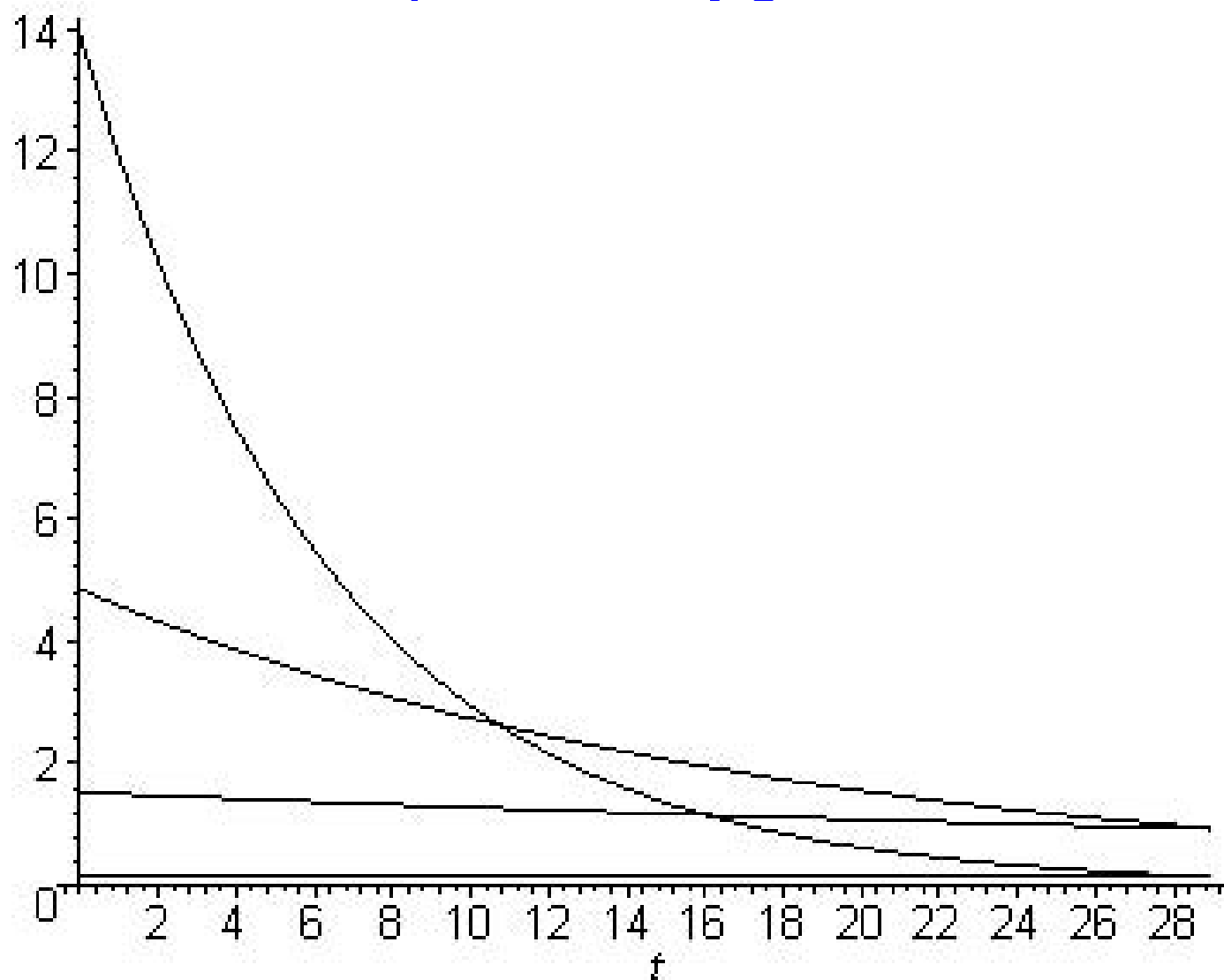
Note: Steady states for the full range of degrees of financial softness

Time path of bankruptcy threshold



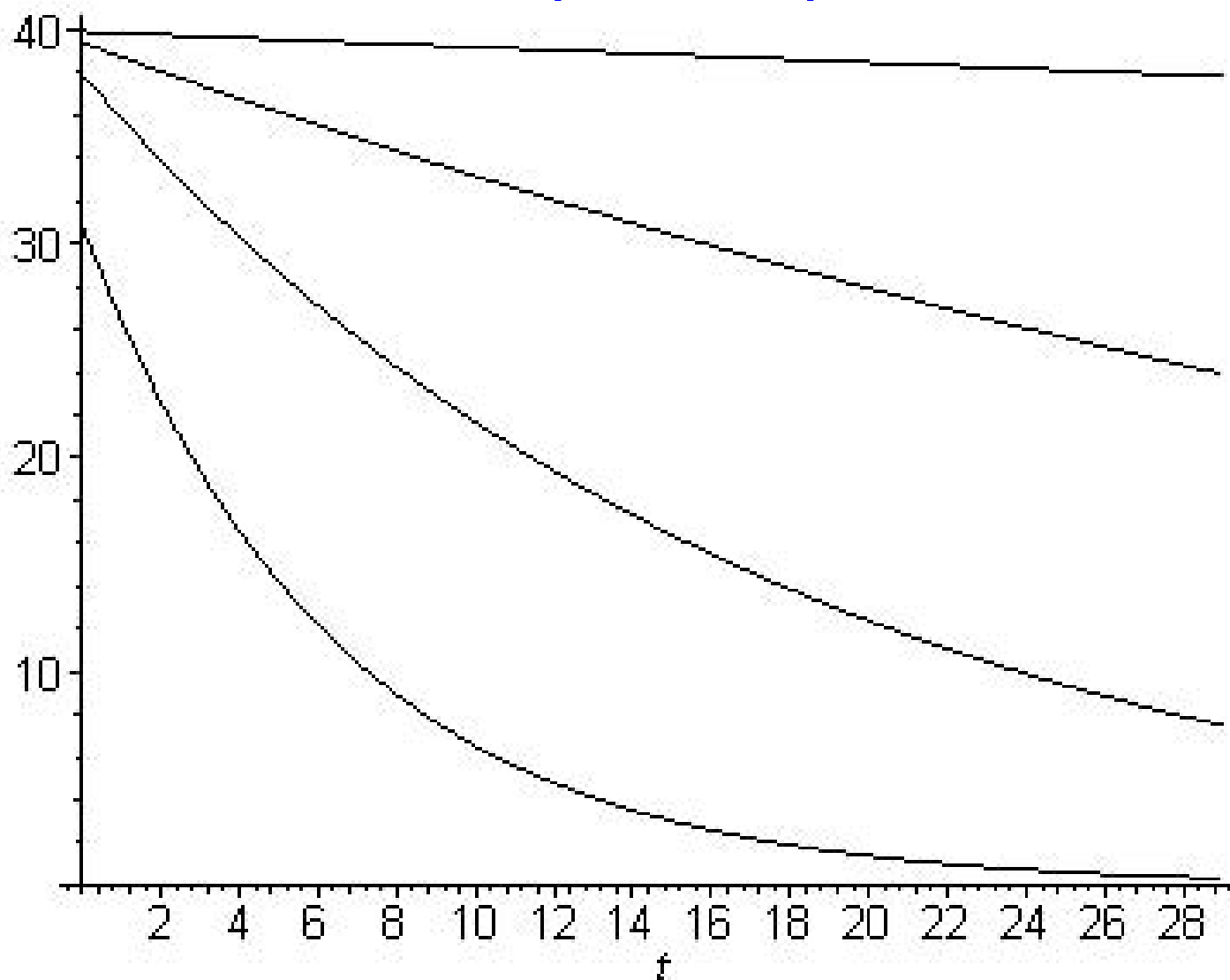
Note: Percentage deviation from its steady state for $s=0.3$, $s=0.5$ and $s=0.7$

Time path of money growth rate



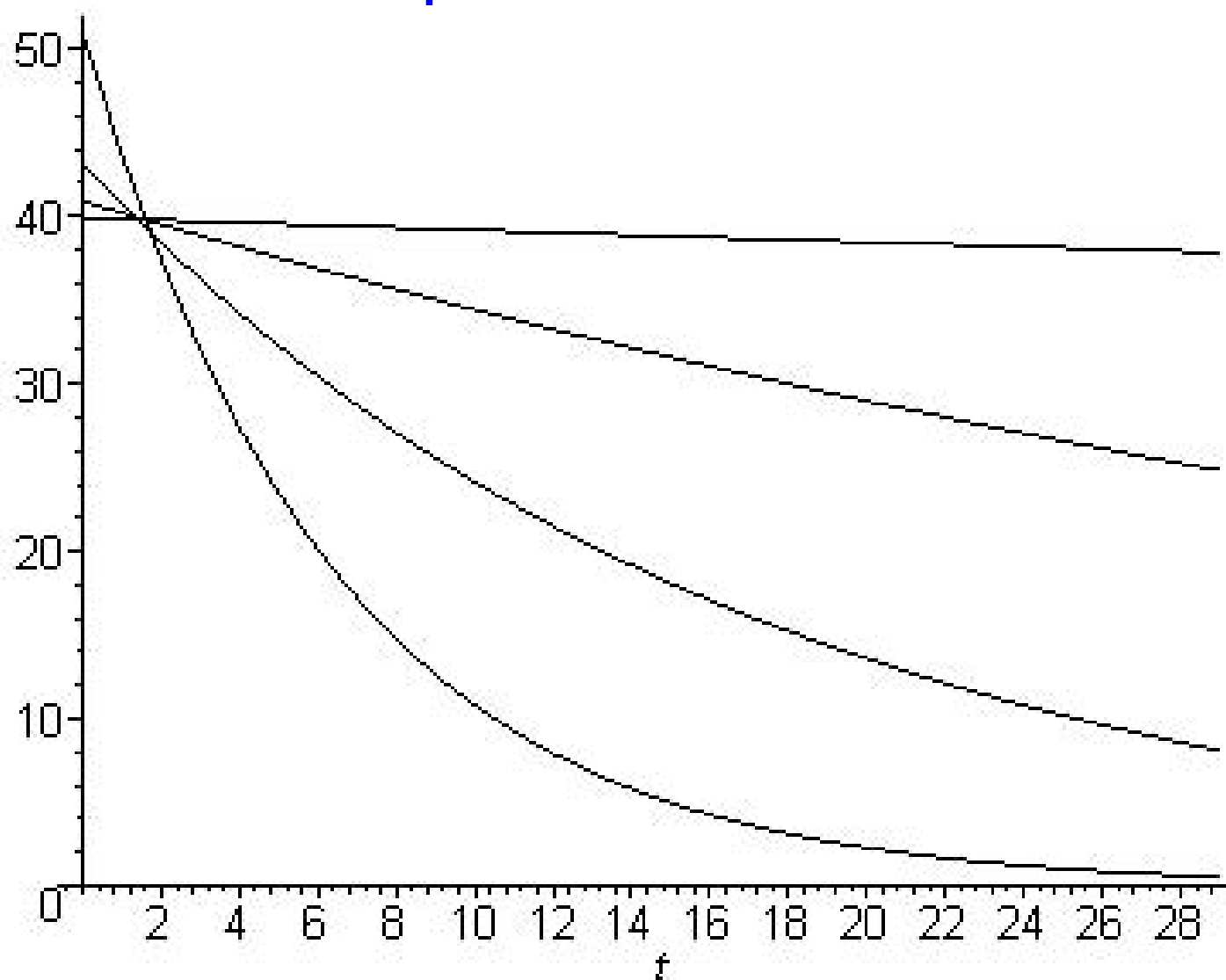
Note: Percentage deviation from its steady state for $s=0.3$, $s=0.5$, $s=0.7$ and $s=0.9$

Time path of output



Note: Percentage deviation from its steady state for $s=0.3$, $s=0.5$, $s=0.7$ and $s=0.9$

Time path of real bail-out funds



Note: Percentage deviation from its steady state for $s=0.3$, $s=0.5$, $s=0.7$ and $s=0.9$

Concluding Remarks

- Bail-in policies produce sustainable and well-fare improving outcomes at below medium degrees of financial softness – i. e. through relaxation of companies' borrowing constraints allowing the intratemporal accumulation of risks at banking and monetary level.
- Higher financial softness produces inferior GE outcomes related to reduced production, consumption and welfare, incl. desinflationary trap in the longer-term. Temporary shocks could become long-lived and nearly permanent.
- Regulatory and supervisory vigilance is preferable to relying on automatic stabilisation role of bail-in policies and illusory ring-fencing.