Debt dynamics in the Great Moderation and beyond

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The Great Moderation in the U.S. - 1984 to 2007

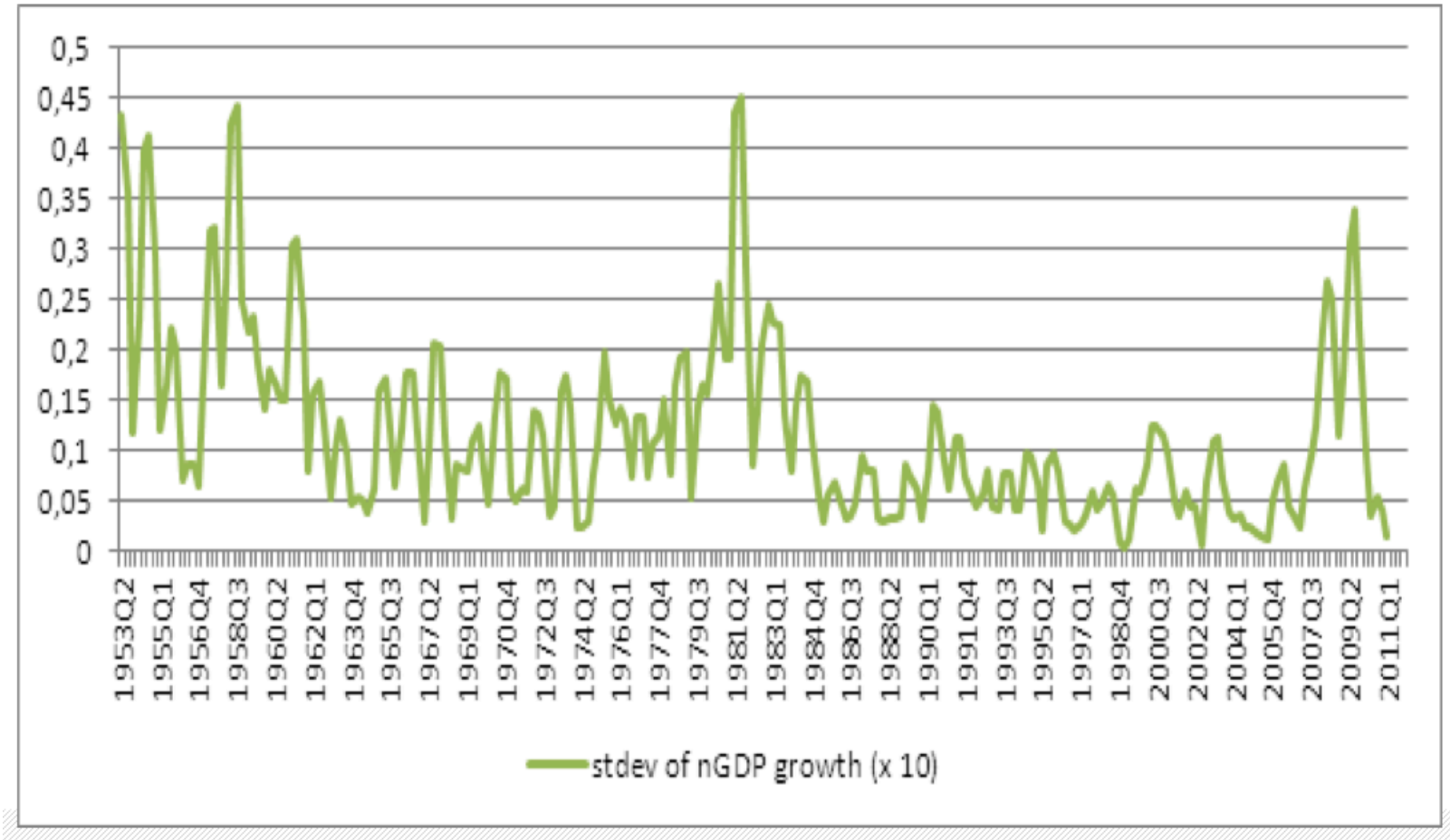


Figure: Grydaki and Bezemer (2013)

Possible explanations

- Real-sector causes: inventory management, labour market changes, responses to oil shocks, external balances , etc.
- Financial-sector causes: credit accelerator models, financial innovation, deregulation, better monetary policy, etc.
- Grydaki and Bezemer (2013): growth of debt in the real sector.

Bank credit-to-GDP ratio in the U.S

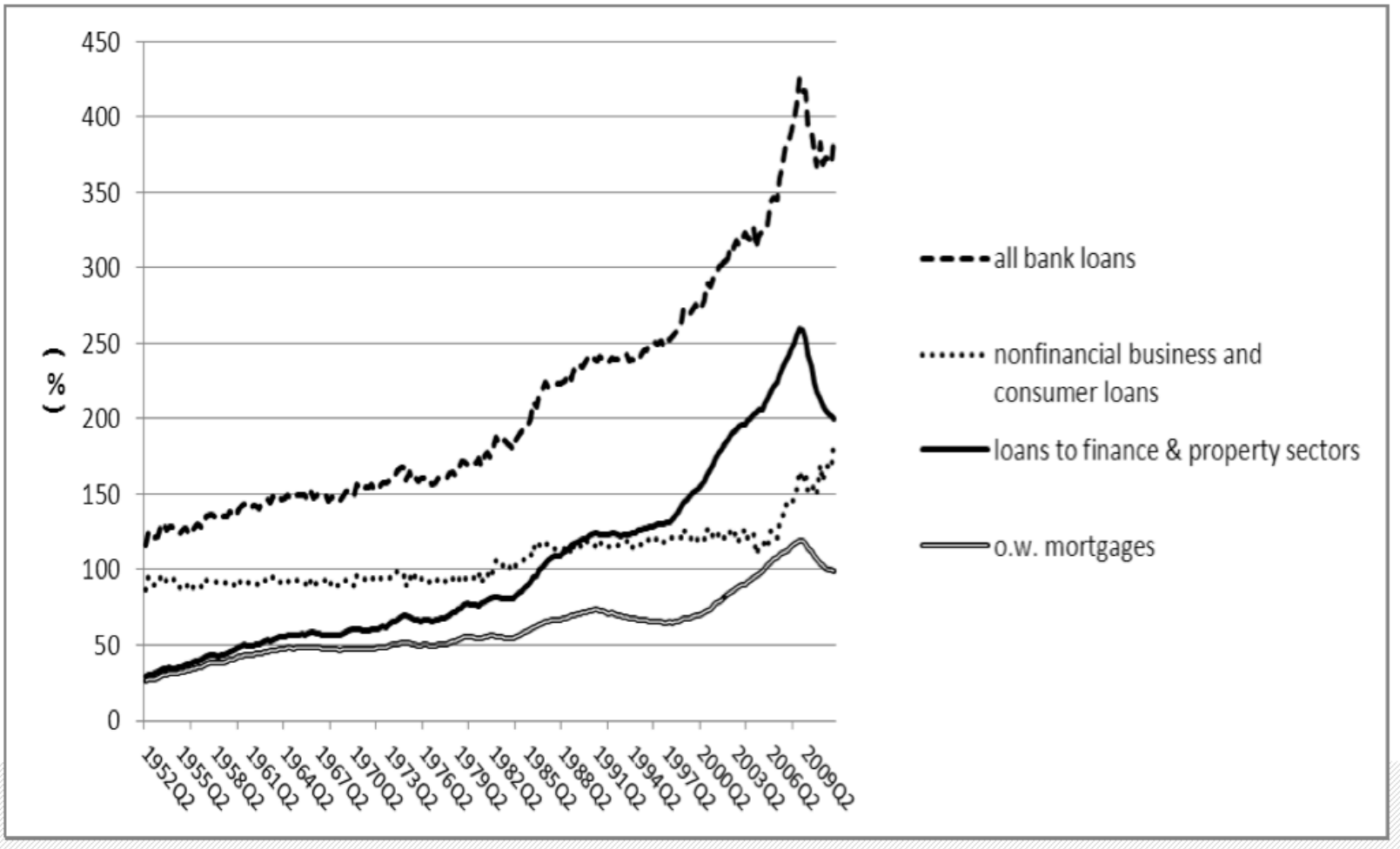


Figure: Grydaki and Bezemer (2013)

Cumulative percentage point growth of excess credit growth, 1952-2008

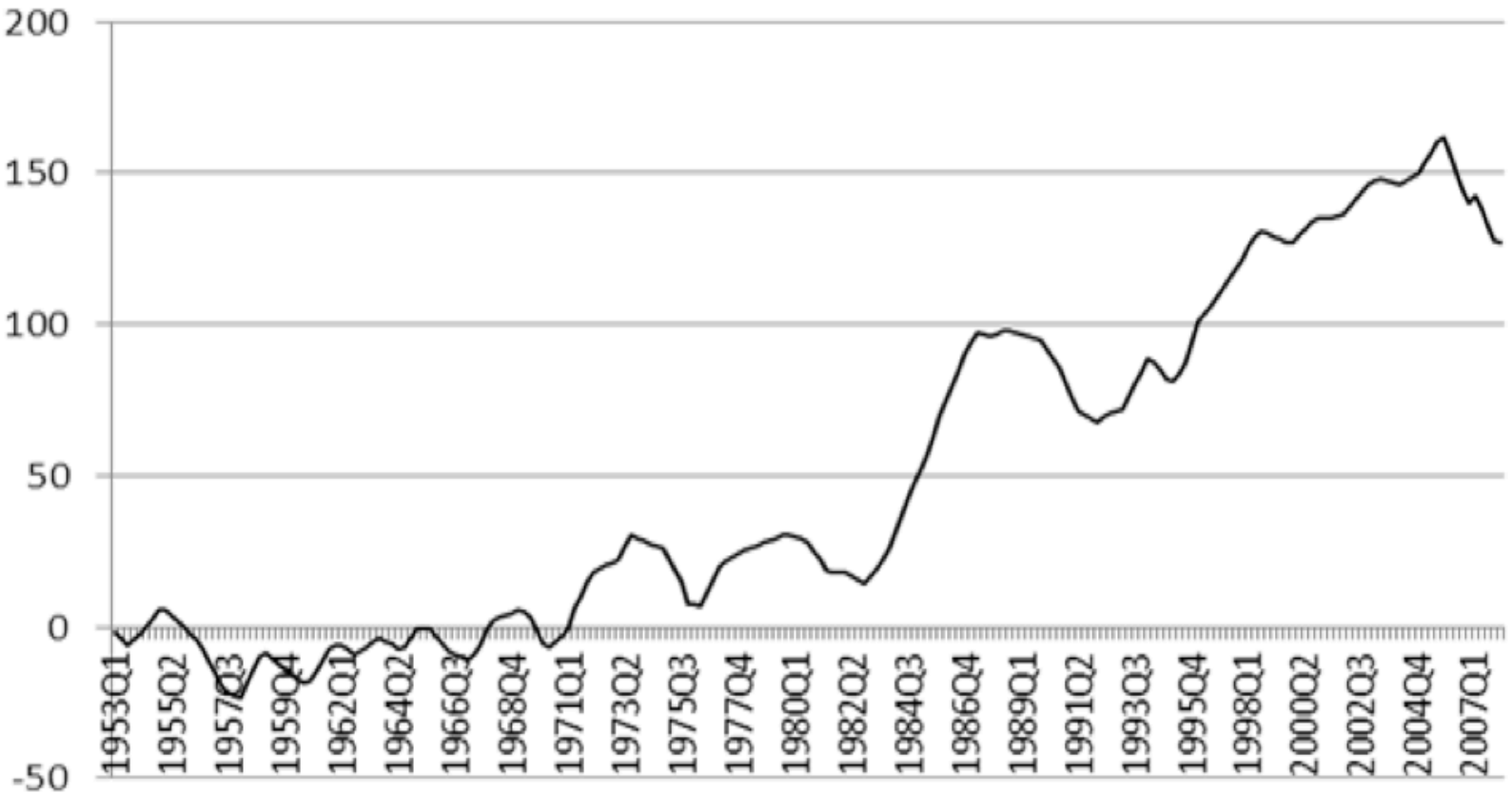


Figure: Grydaki and Bezemer (2013)

Excess credit growth moderated output volatility during, but not before the Great Moderation

Before the Great Moderation	*During the Great Moderation*
change in interest rate (-) => output volatility	excess credit growth (-) => output volatility
change in interest rate (+) => inflation	output volatility (+) => excess credit growth
excess credit growth (+) => change in interest rate	output volatility (-) => change in interest rate
	excess credit growth (+) => change in interest rate
	inflation (+) => change in interest rate

Note: In the table, x (-) => y denotes that a one-standard deviation shock in variable x impacts negatively on the change of variable y. Similarly, x (+) => y indicates a positive impact.

Figure: Grydaki and Bezemer (2013)

Godley table for the Keen model

Balance Sheet	Households	Firms current	Firms capital	Banks	Sum
Capital goods			$+K$		$+K$
Deposits	$+M_h$		$+M_f$	$-M$	0
Loans			$-L$	$+L$	0
Sum (net worth)	V_h		V_f	V_b	$+K$
Transactions					
Consumption	$-C$	$+C$			0
Investment		$+I$	$-I$		0
Accounting memo [GDP]		[Y]			
Wages	$+W$	$-W$			0
Interest on M	$+r_M M_h$	$+r_M M_f$		$-r_M M$	0
Interest on L		$-r_L L$		$+r_L L$	0
Profits		$-F_f$	$+F_{fu}$		0
Financial Balances	S_h	0	S_f	S_b	0
Flow of Funds					
Deposits	$-\dot{M}_h$		$-\dot{M}_f$	$+\dot{M}$	0
Loans			$+\dot{L}$	$-\dot{L}$	0
Column sum	0	0	0	0	0

Special case: Keen (1995)

- Let $D = L - M_f$ and assume that $r_M = r_F = r$.
- Supposing further that $\Phi = \Phi(\lambda)$ and $I = \kappa(\pi)Y$, where $\pi = 1 - \omega - rd$, leads to

$$\dot{\omega} = \omega\left[\Phi(\lambda) - \alpha\right]$$

$$\dot{\lambda} = \lambda\left[\frac{\kappa(1-\omega-rd)}{\nu} - \alpha - \beta - \delta\right] \tag{1}$$

$$\dot{d} = d\left[r - \frac{\kappa(1-\omega-rd)}{\nu} + \delta\right] + \kappa(1-\omega-rd) - (1-\omega)$$

Equilibria

- The system (1) has a good equilibrium at

$$\overline{\omega} = 1 - \overline{\pi} - r\frac{\nu(\alpha+\beta+\delta)-\overline{\pi}}{\alpha+\beta}$$

$$\overline{\lambda} = \Phi^{-1}(\alpha)$$

$$\overline{d} = \frac{\nu(\alpha+\beta+\delta)-\overline{\pi}}{\alpha+\beta}$$

with

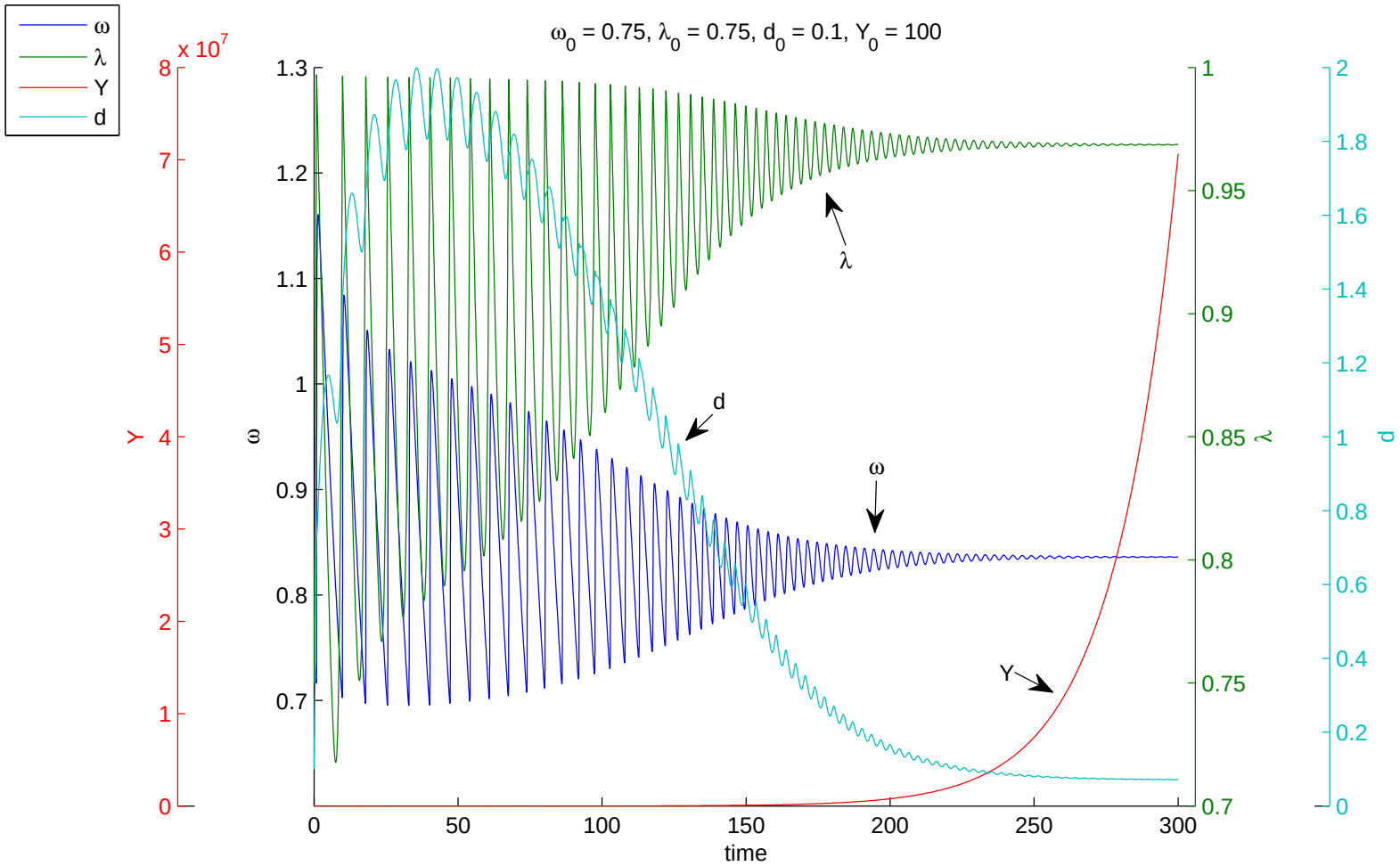
$$\overline{\pi} = \kappa^{-1}(\nu(\alpha+\beta+\delta)),$$

which is stable for a large range of parameters

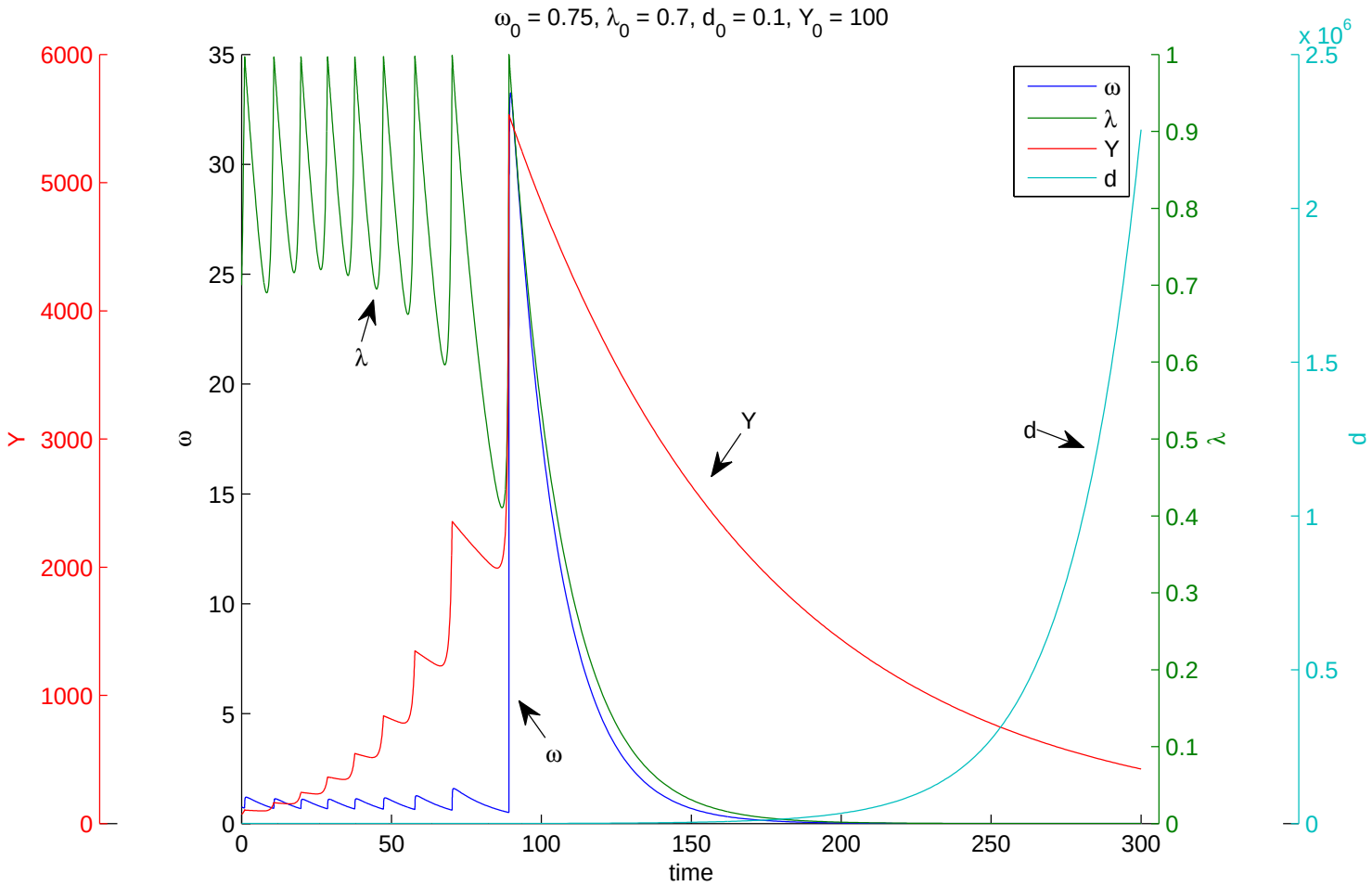
- It also has a bad equilibrium at $(0, 0, +\infty)$, which is stable if

$$\frac{\kappa(-\infty)}{\nu} - \delta < r \tag{2}$$

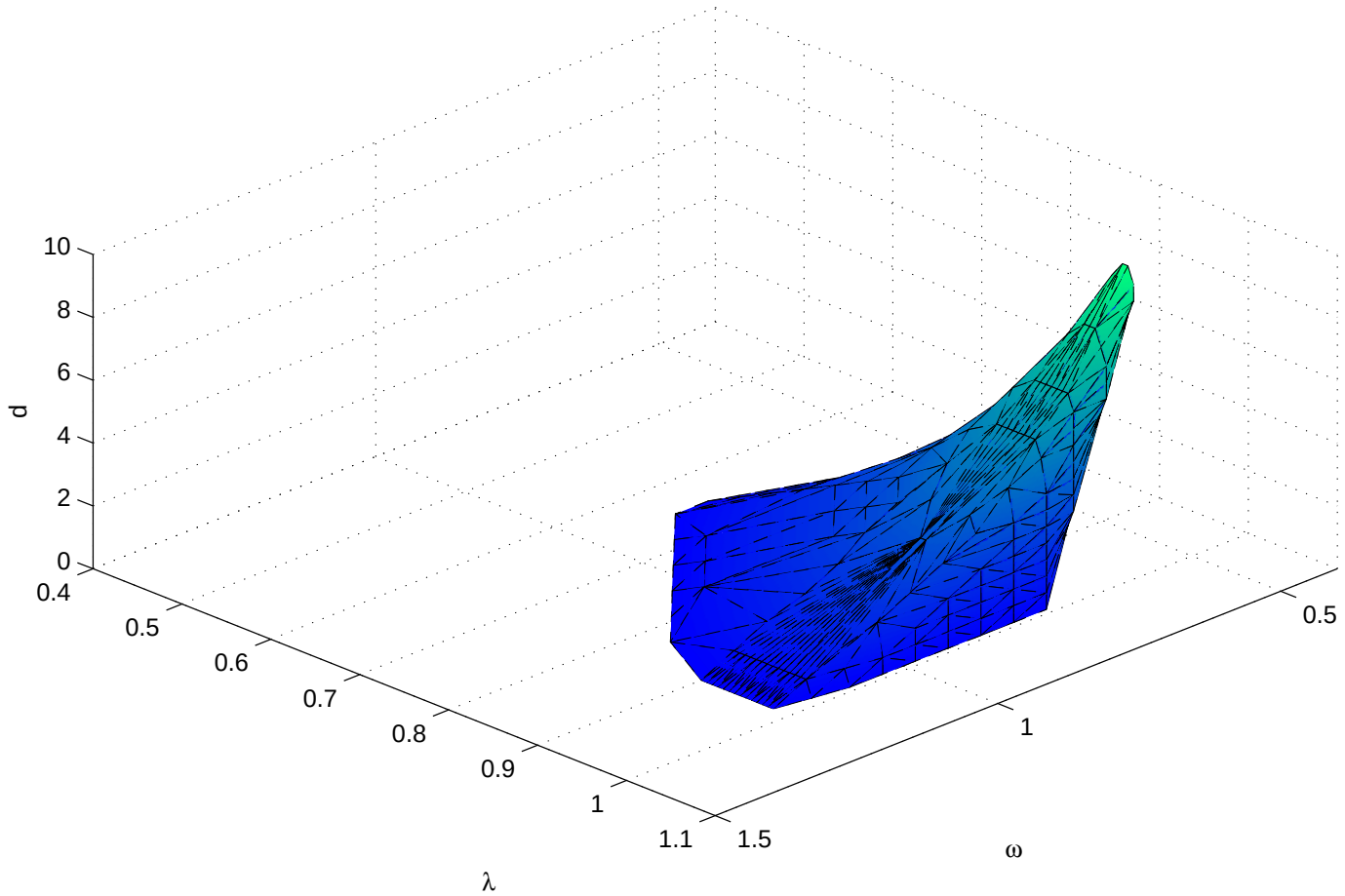
Example 1: convergence to the good equilibrium in a Keen model



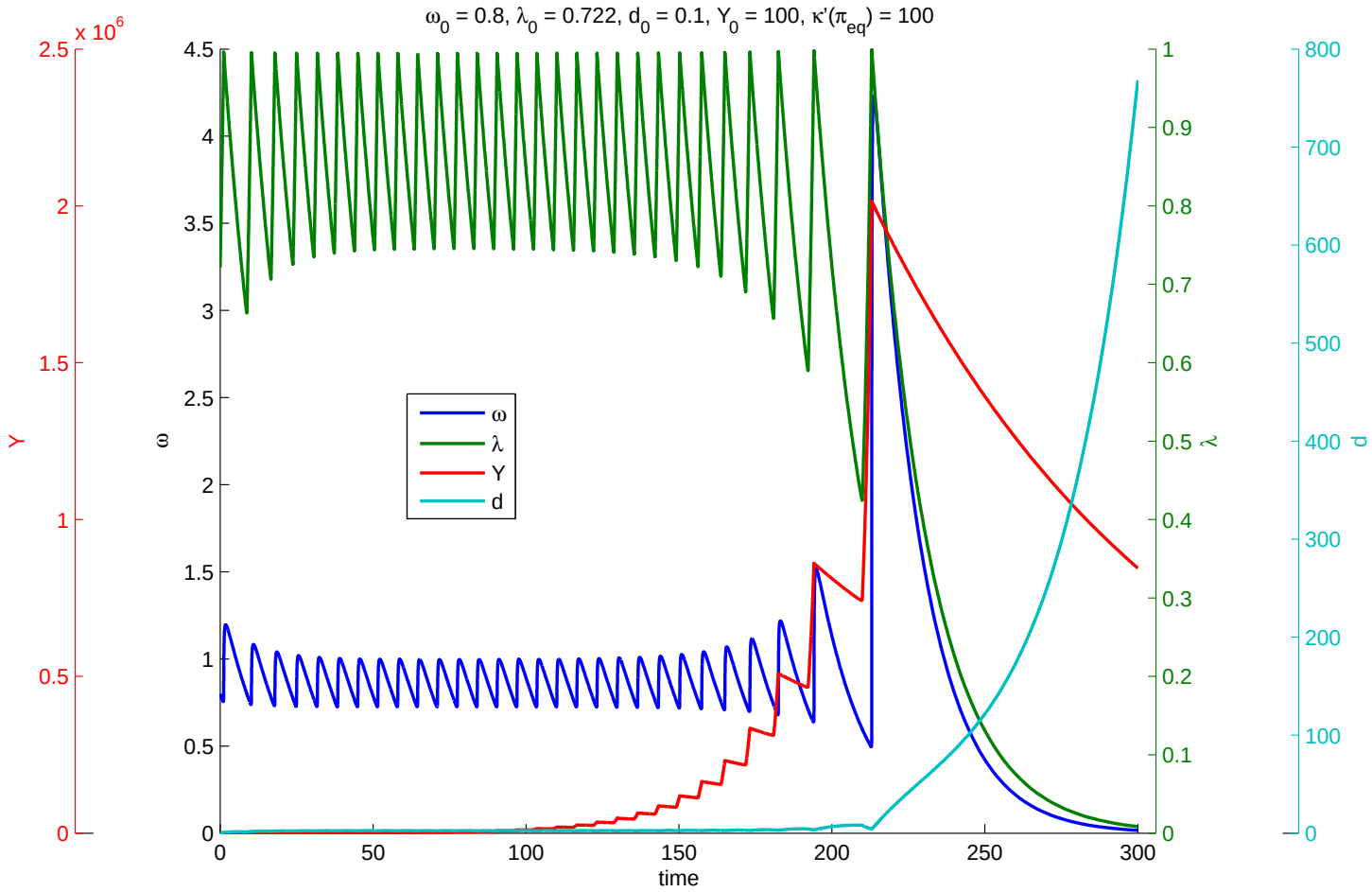
Example 2: explosive debt in a Keen model



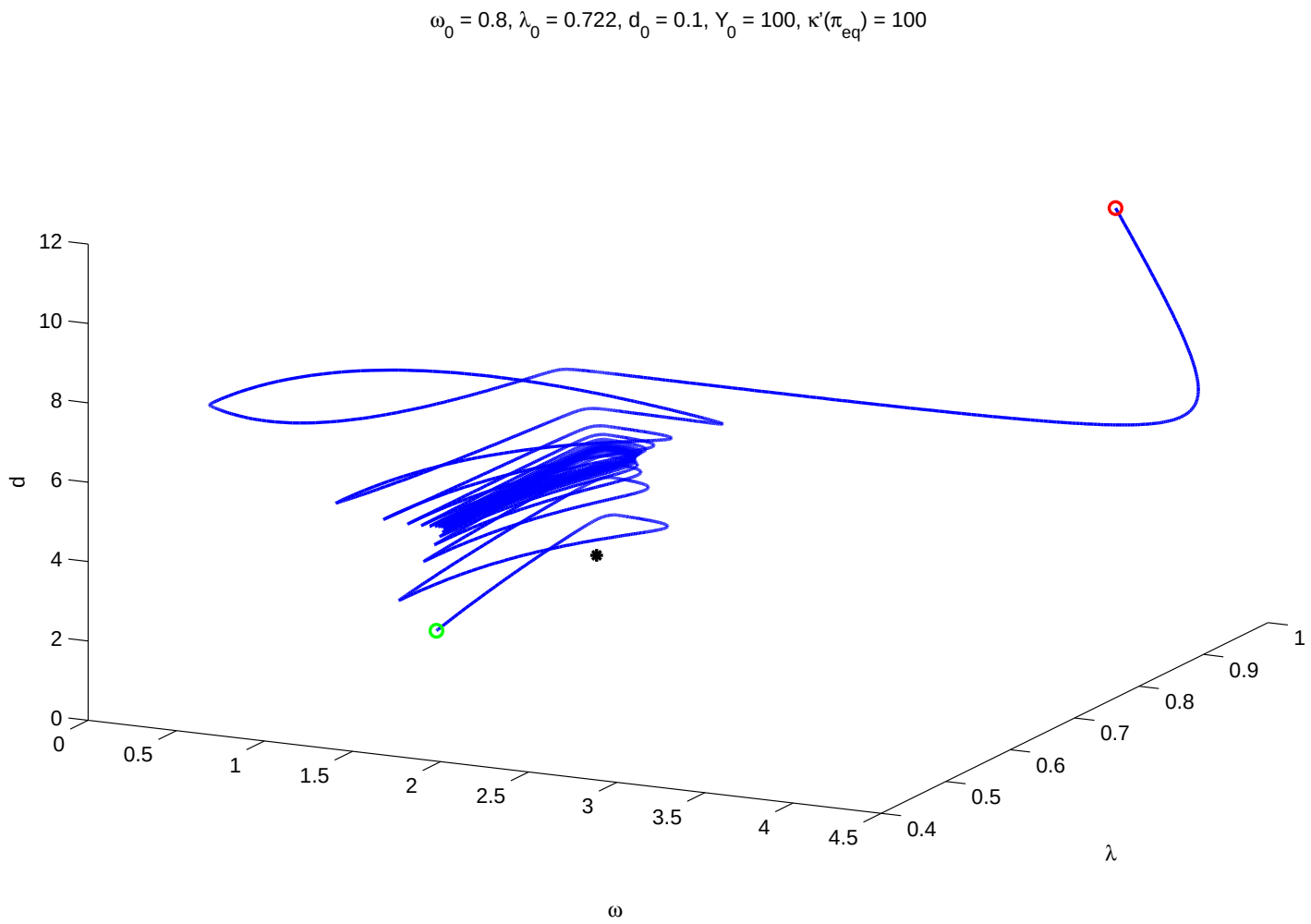
Basin of convergence for Keen model



Example 3: weakly moderated oscillations



Example 3 (cont): weakly moderated oscillations in 3d



Adding speculation by firms

- As one way to explain credit growth in excess of GDP growth, GB 2013 observe that "there is extensive evidence that during the Great Moderation nonfinancial firms increasingly realized their returns in financial transactions".
- We model this by introducing Ponzi speculation in the form

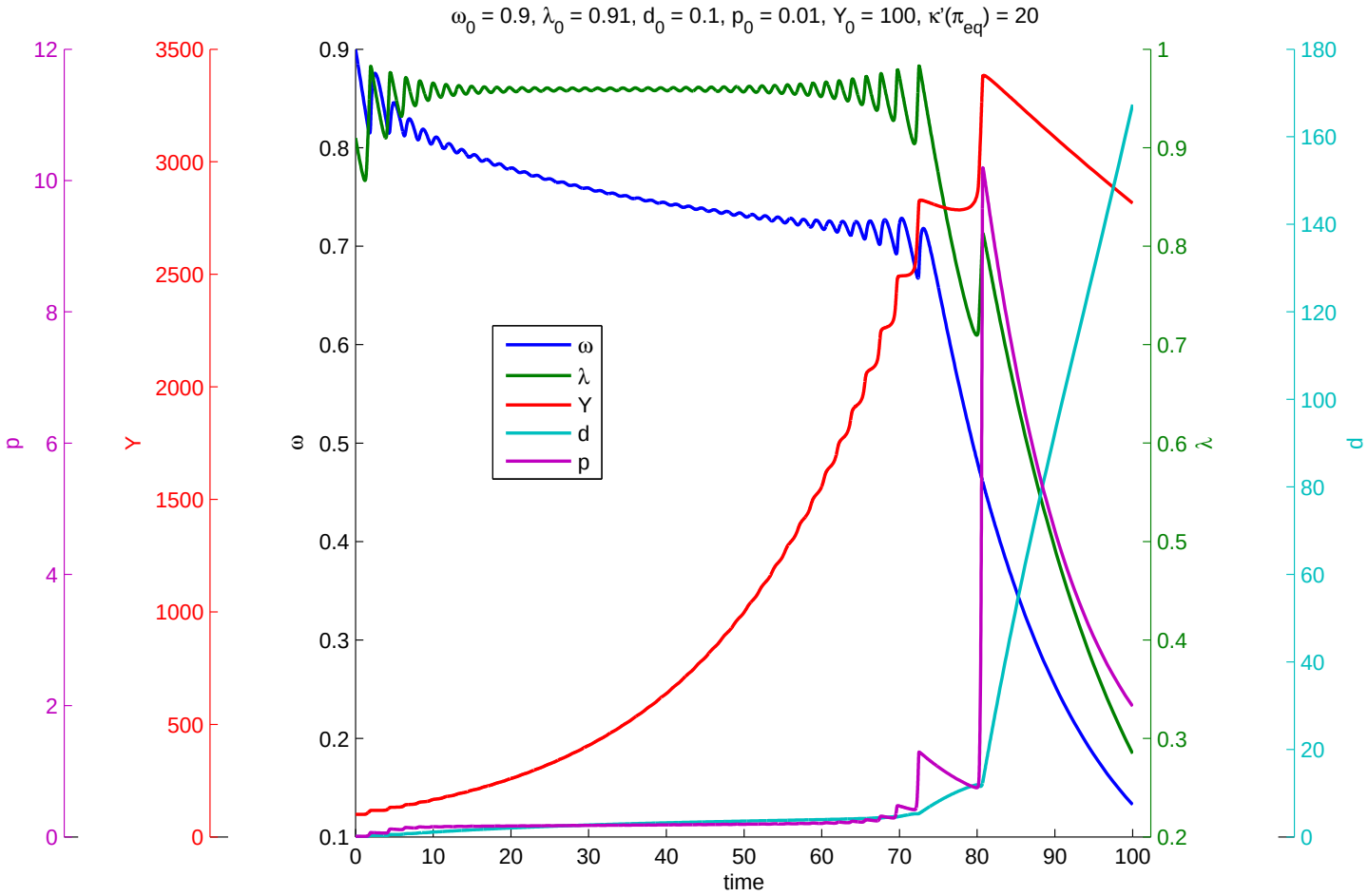
$$\dot{D} = \kappa(1-\omega-rd)Y - (1-\omega-rd)Y + P$$
$$\dot{P} = \Psi(g(\omega,d)P$$

where

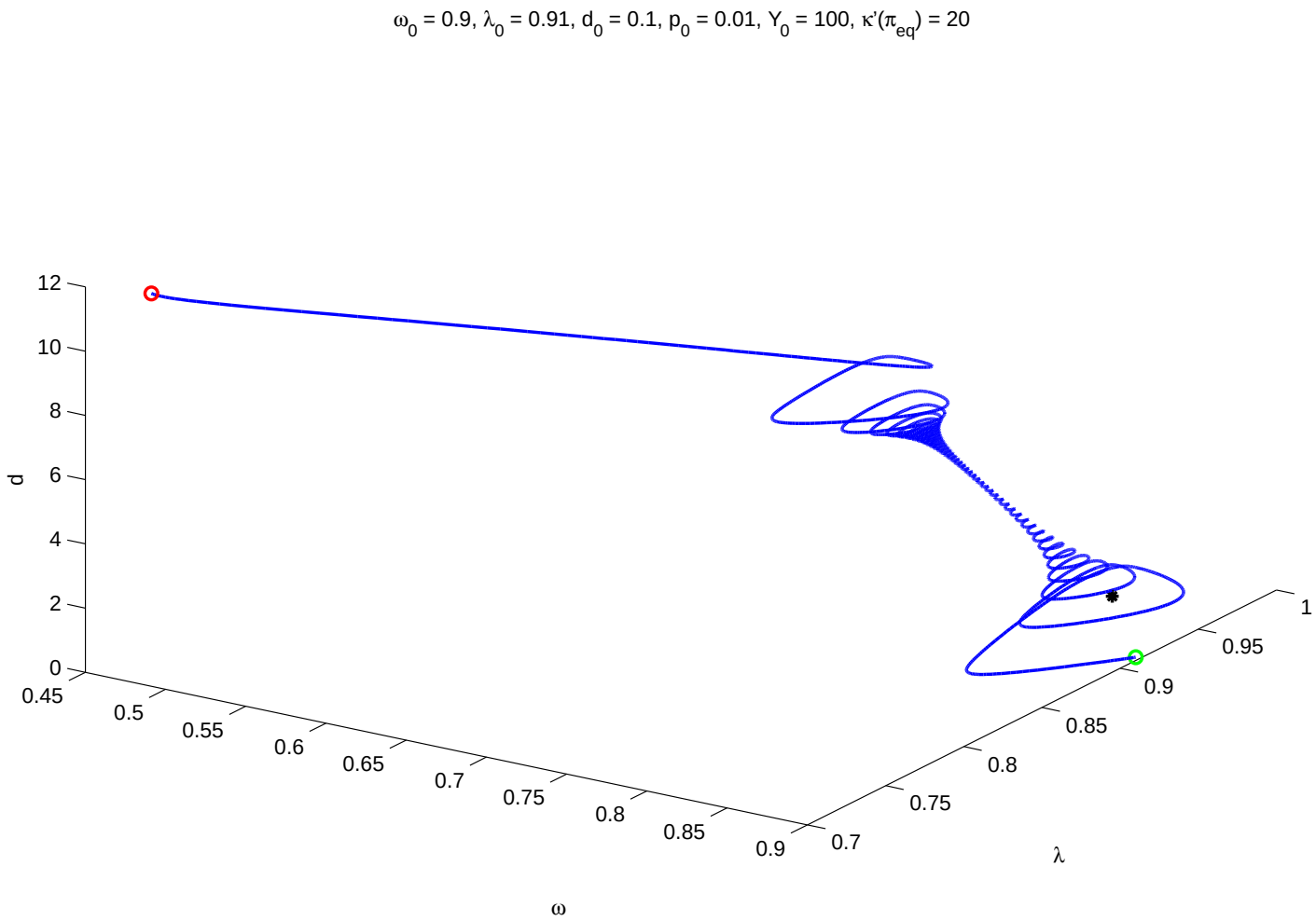
$$g(\omega,d) = \frac{\kappa(1-\omega-rd)}{\nu} - \delta,$$

is the growth rate of the economy.

Example 4: strongly moderated oscillations



Example 4 (cont): strongly moderated oscillations in 3d



Preliminary conclusions and policy implications

- Stability is destabilizing!
- In boom times, debt-financing decreases volatility, but leads to excessive leverage.
- Price stability is not enough: capital requirements should go hand-in-hand with monetary policy.
- After a crash, deleveraging is the dominant effect.
- Debt relief is much more important than monetary easing.

Next steps

- Joint work with Grydaki and Bezemer to calibrate the theoretical model to empirical data.
- Investigate the stable-unstable phenomenon in the context of Shilnikov's saddle-node bifurcations.
- Extend the model to incorporate price dynamics and other types of speculation (e.g real estate).