On the normality of negative interest rates

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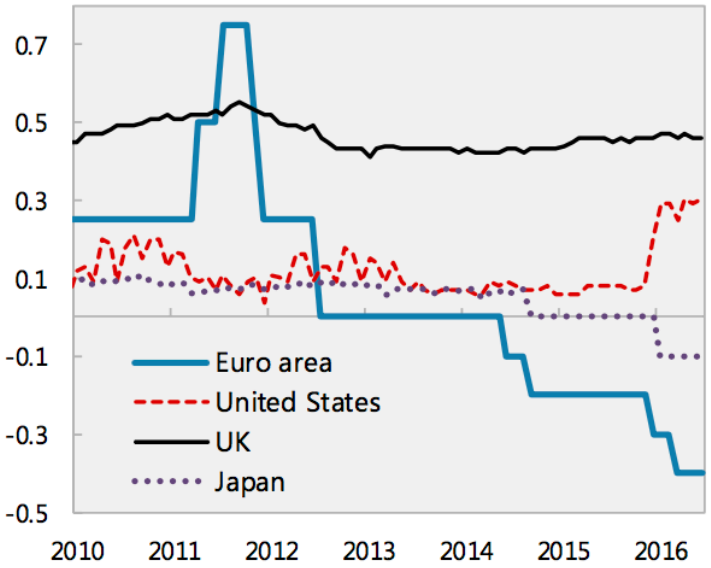
Mathematics and Statistics - McMaster University
Based on joint work with Alex Lipton

Arts and Sciences Guest Lecture
October 27, 2017

Select Central Bank Policy Rates 2010-2016

Major Reserve Currencies: Effective Marginal Policy Rates, 2010-2016
(Percent)



Source: Bloomberg, L.P.; and Haver Analytics.
Note: Policy rates used for each country are the following: EA: deposit rate; US: Fed funds rate; UK: O/N interbank rate; Japan: deposit rate.

Other Currencies: Effective Marginal Policy Rates, 2010-2016
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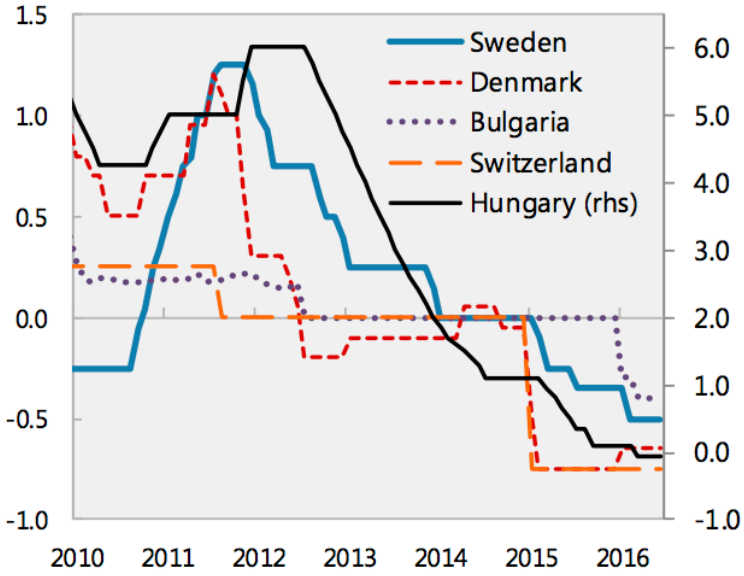

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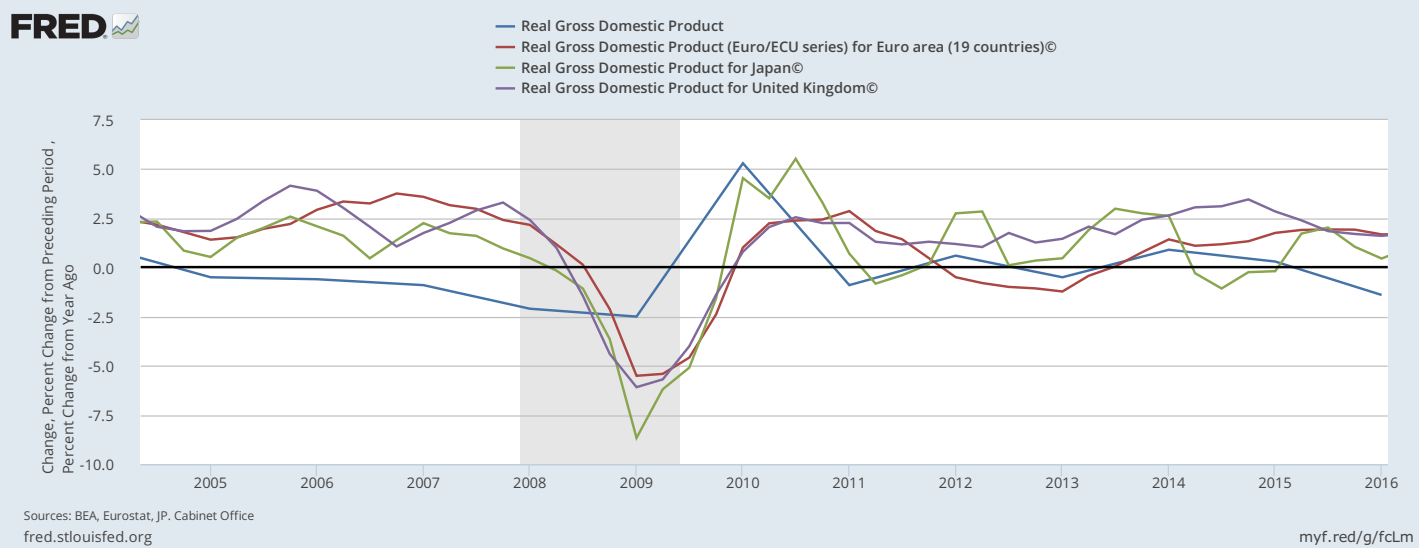
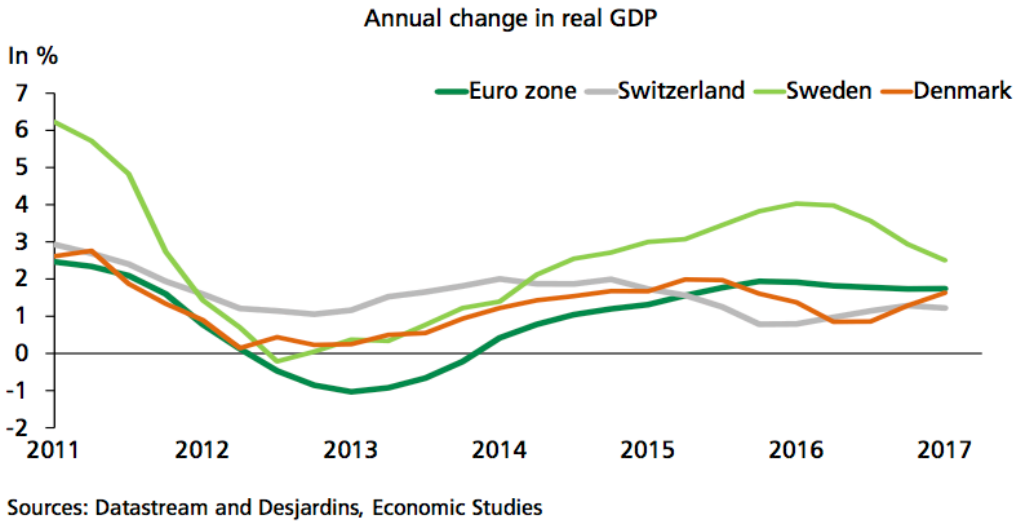
Why was it deemed necessary?





Stated reasons

- Denmark: counter safe-haven inflow and exchange rate pressure.
- Euro area: price stability.
- Hungary: price stability and counter exchange rate pressure.
- Japan: price stability.
- Norway: price stability.
- Sweden: price stability.
- Switzerland: counter safe-haven inflow and exchange rate pressure.

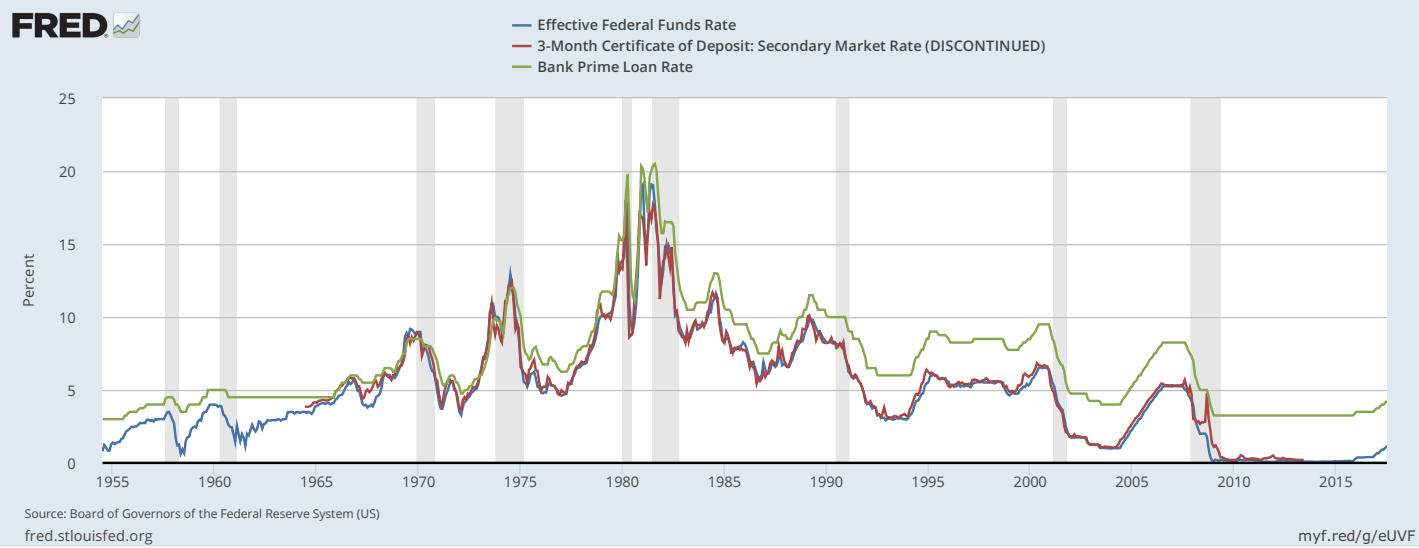
How was NIRP greeted?

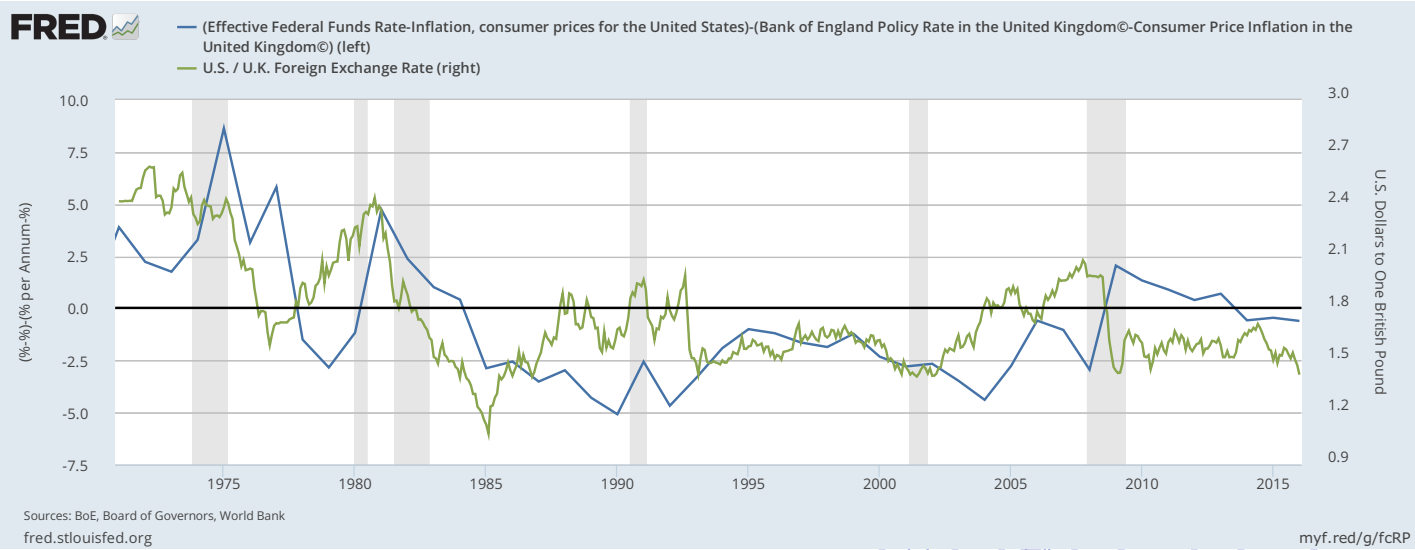
- Keynesian economists view it as a poor substitute for fiscal policy.
- Robert Skidelsky (2016): "the real case against negative interest rates is the folly of relying on monetary policy alone to rescue economies from depressed conditions".
- Austrian economists view it as the latest attempt of government take over of the economy.
- Frank Hollenbeck (2016): "radical monetary policy that will only ensure an ever greater misalignment between output and demand".

How is a rate cut supposed to work in positive territory?

- Reduction in bank deposit and lending rates: cheaper short-term funding from the central bank plus competition leads to lower costs passed to clients via lower lending rates. Shift from short-maturity liquid assets with lower returns increases price of riskier, illiquid assets, further lowering lending rates. Competition from wholesale funding and support of margins leads to lower deposit rates.
- Increase in aggregate demand: because firms typically borrow to invest, lower lending rates lead to more investment. Provided the lost interest income does not lead to lower consumption (as richer households typically save more anyway), this boosts aggregate demand and therefore inflation.
- Currency depreciation: incentive for moving capital to higher-yield jurisdictions.

Effects of policy rate changes (1955-2015)





What's different in negative territory?

- The existence of cash (with zero gross nominal rate of return) provides a "physical lower bound" (PLB), lower than then zero lower bound (ZLB), but bounded nonetheless.
- This prevents deposits from following the policy rate into negative territory.
- Reputational risk and consumer behaviour make banks even more hesitant to pass negative rates to deposits.
- If lending rates decrease because the policy rate goes negative, this reduces bank profitability.
- Banks would then reduce lending to protect capital ratios.
- This creates an "economic lower bound", lower than the ZLB but higher than the PLB.
- See Brunnermeier and Koby (2016).

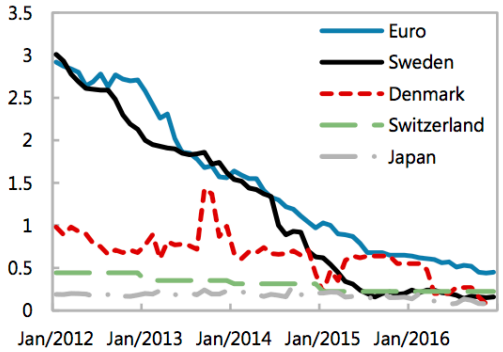
How did it work? IMF Policy Paper (August 2017)

- Deposit rates remained positive (with the exception of large deposits in Denmark, Sweden, and Switzerland).
- Lending rates declined as expected (with the exception of Switzerland for a brief period, then normalized).
- Bank profits remained constant (higher lending volumes, fees and commissions, capital gains, lower provisioning costs).
- Mixed results on exchange rates.
- No evidence of cash hoarding.
- Outlook for inflation and growth remains subdued

Effects of NIRP on deposit and lending rates

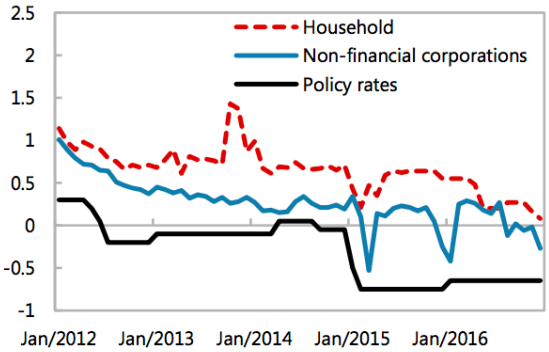
Figure 1. Deposit Rates

Figure 1A. Households' deposit rates
(Percent, maturity less than 1 year)



Sources: Haver Analytics, IMF Staff calculations

Figure 1B. Rates on large deposits, Denmark
(Percent, maturity less than 1 year)



Sources: European Central Bank

Figure 2. Lending Rates and Volumes

Figure 2A. Lending rates
(Percent, maturity less than 1 year)

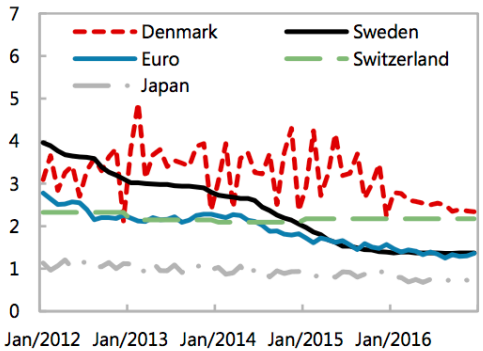


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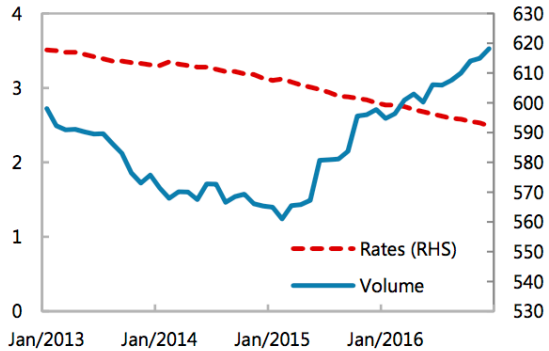
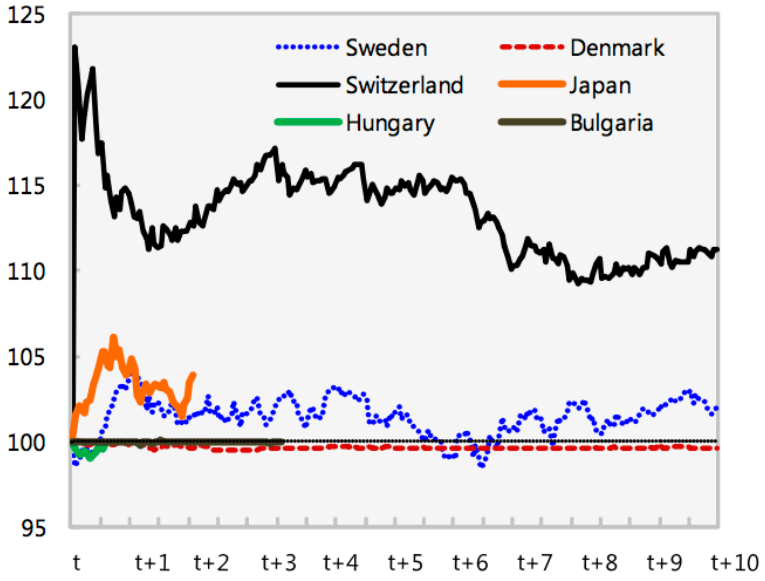
Figure 2B. Mortgage rates and lending volumes in Euro Area
(Maturity over 5 years. Rates: percent. Volume: € millions)



Source: Haver Analytics

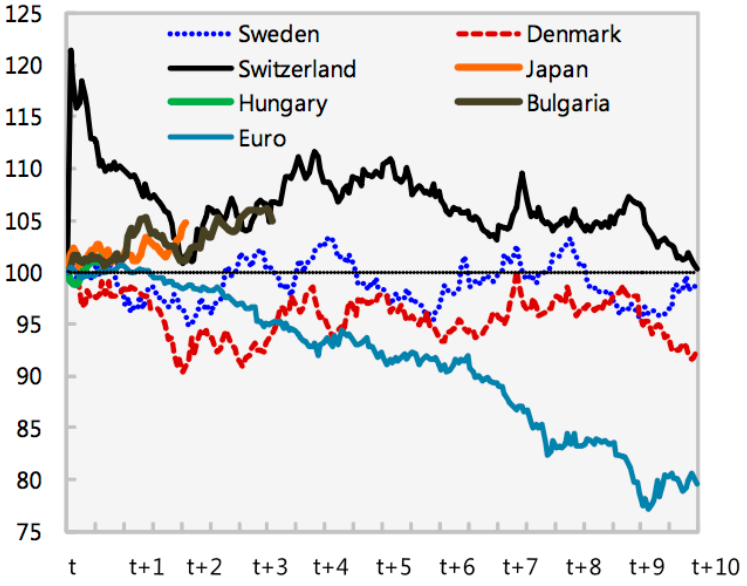
Effects of NIRP on exchange rates

Exchange Rates relative to Euro
(Index, time t = 100, day before introduction of negative deposit rates)



Source: Haver Analytics. Note: the x-axis shows monthly intervals.

Exchange Rates relative to U.S. Dollar
(Index, time t=100, day before introduction of negative deposit rates)



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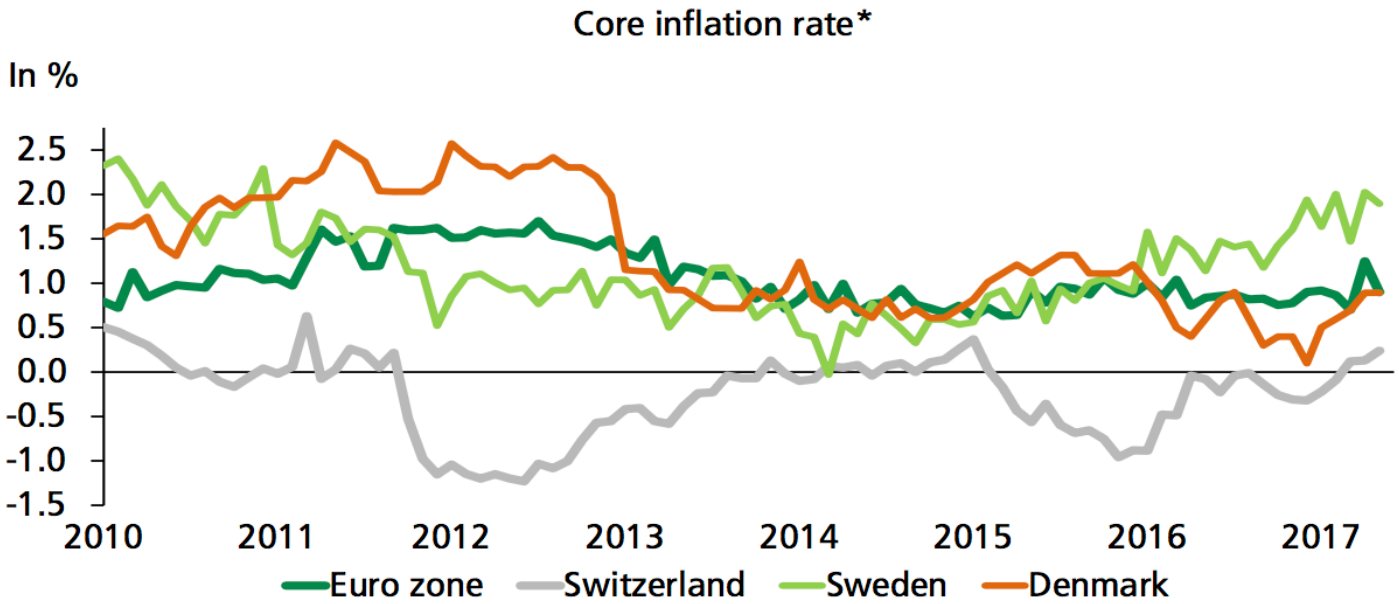
Effects of NIRP on inflation



* Excluding food and energy in the euro zone, Switzerland and Denmark. Excluding the cost of mortgage interest in Sweden.
Sources: Datastream and Desjardins, Economic Studies

What would you expect from such modestly negative rates?

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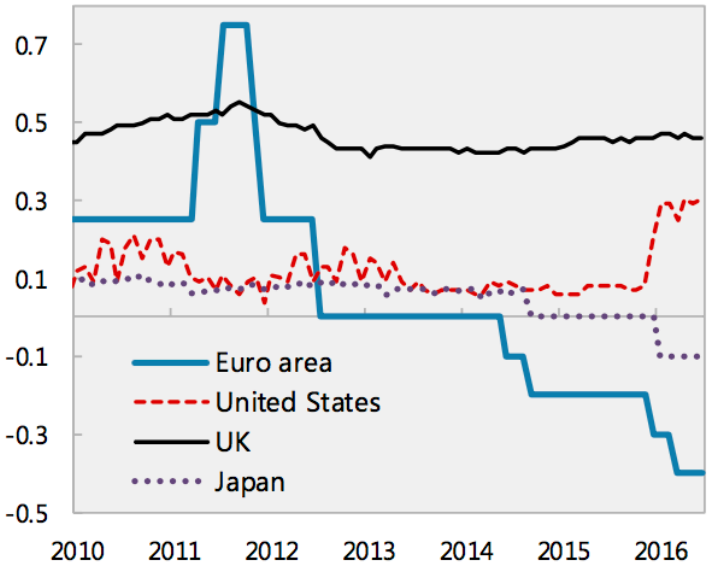

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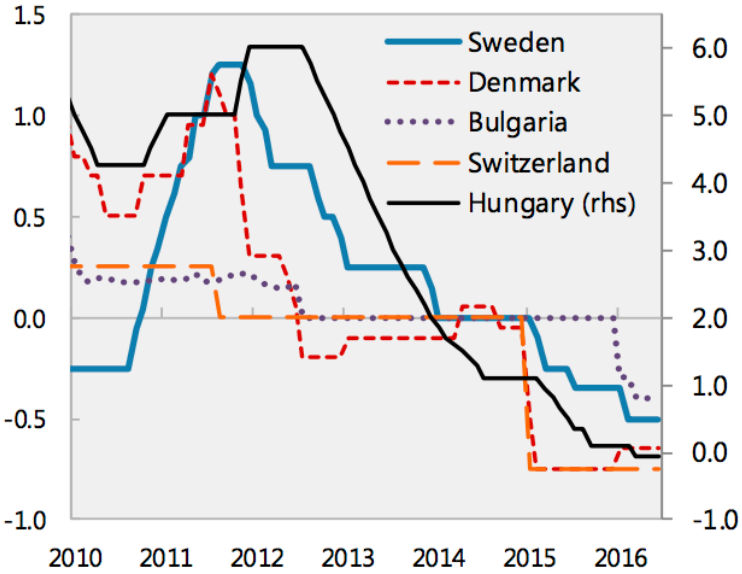

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SFC table for Keen (1995) model

	Households	Firms		Banks	Gov	Sum
Balance Sheet						
Capital stock		$+pK$				$+pK$
Deposits	$+\Delta$			$-\Delta$		0
Loans		$-\Lambda$		$+\Lambda$		0
Bills	$+B$				$-B$	0
Sum (net worth)	X_h	X_f		X_b	X_g	pK
Transactions		current	capital			
Consumption	$-pC$	$+pC$				0
Gov Spending		$+pG$			$-pG$	0
Capital Investment		$+pI$	$-pI$			0
Accounting memo [GDP]		$[pY]$				
Wages	$+W$	$-W$				0
Taxes		$-pT$			$+pT$	0
Depreciation		$-p\delta K$	$+p\delta K$			0
Interest on deposits	$+r_d\Delta$			$-r_d\Delta$		0
Interest on loans		$-r\Lambda$		$+r\Lambda$		0
Interest on Bills	$+r_gB$				$-r_gB$	0
Dividends	$+\Pi_b$			$-\Pi_b$		0
Financial Balances	S_h	S_f	$-p(I-\delta K)$	S_b	S_g	0
Flow of Funds						
Change in Capital Stock		$+p(I-\delta K)$				$+p(I-\delta K)$
Change in Deposits	$+\dot{\Delta}$			$-\dot{\Delta}$		0
Change in Loans		$-\dot{\Lambda}$		$+\dot{\Lambda}$		0
Change in Bills	$-\dot{B}$				$+\dot{B}$	0
Column sum	S_h	S_f		S_b	S_g	$p(I-\delta K)$
Change in net worth	S_h	$S_f+\dot{p}K$		S_b	S_g	$\dot{p}K+p\dot{K}$

Table: SFC table for the Keen model.

Fiscal and monetary policies

- Assume a fiscal stance of the form

$$G = gY$$
$$T = tY$$

where g and t are positive constants.

- Government debt then evolves as

$$\dot{B} = pG - pT + r_g B.$$

- In addition, let the monetary policy be

$$\dot{\rho} = \eta_g \left(\frac{\dot{K}}{K} - \alpha - \beta \right)$$
$$\dot{r}_g = \eta_r (\rho - r_g),$$

where η_r, η_g are non-negative constants and $(\alpha + \beta)$ is the potential output growth.

Growth and investment

- Assume that $Y = K/\nu$ and that

$$\dot{K} = I - \delta K.$$

- Moreover, let $I = \kappa(\pi)Y$, for an increasing function $\kappa(\cdot)$ of the profit share π defined as

$$\pi = \frac{\Pi_p}{pY} = 1 - \omega - t - r\ell,$$

where $\omega = W/(pY)$ and $\ell = \Lambda/(pY)$.

Inflation, wages, employment and bank rates

- For the wage-price dynamics we assume that

$$\frac{\dot{p}}{p} = \eta_p(m\omega - 1) := i(\omega)$$
$$\frac{\dot{w}}{w} = \Phi(\lambda) + \gamma i(\omega).$$

  for $m \geq 1$, $\eta_p \geq 0$, and $\gamma \in \mathbb{R}$.
- Let $\lambda = Y/(aN)$ be the employment rate, where

$$\dot{a}/a = \alpha, \qquad \dot{N}/N = \beta.$$

- Set $r_d = r_g$ and $r = r_g + \delta_r$.

The full dynamical system

The entire model reduces to the following system of differential equations:

$$\begin{cases} \dot{\omega} &= \omega\left[\Phi(\lambda) - \alpha - (1-\gamma)i(\omega)\right] \\ \dot{\lambda} &= \lambda\left[\frac{\kappa(\pi)}{\nu} - \delta - \alpha - \beta\right] \\ \dot{\ell} &= \ell\left[r_g + \delta_r - \frac{\kappa(\pi)}{\nu} + \delta - i(\omega)\right] + \omega + t + \kappa(\pi) - 1 \\ \dot{\rho} &= \eta_g\left(\frac{\kappa(\pi)}{\nu} - \delta - \alpha - \beta\right) \\ \dot{r}_g &= \eta_r(\rho - r_g) \end{cases}$$

Interior equilibrium

- It is easy to see that an interior equilibrium is given by

$$\begin{aligned}
\overline{\omega}_1 &= 1 - \overline{\pi}_1 - t - (\overline{r}_0 + \delta_r)\overline{\ell}_1 \\
\overline{\lambda}_1 &= \Phi^{-1}[\alpha + (1-\gamma) i(\overline{\omega}_1)] \\
\overline{\ell}_1 &= \frac{\kappa(\overline{\pi}_1) - \overline{\pi}_1}{\alpha + \beta + i(\overline{\omega}_1)} \\
\overline{r}_g &= \overline{\rho}
\end{aligned}$$

  where $\overline{\pi}_1 := \kappa^{-1}(\nu(\alpha + \beta + \delta))$.

- Moreover, we find that this equilibrium induces an asymptotic government debt ratio of the form

$$\overline{b}_1 = \frac{g - t}{i(\overline{\omega}_1) + \alpha + \beta - \overline{r}_g}$$

Numerical examples

$$\Phi(\lambda) = a + \frac{b}{(1-\lambda)^2}, \qquad \kappa(\pi) = c + \exp(d + e\pi)$$

Symbol	Value	Description
a	-0.0401	constant term in Phillips curve
b	0.0001	coefficient phillips curve
c	-0.0065	constant term in investment function
d	-5	affine term in exponent of investment function
e	20	coefficient in exponent of investment function
m	1.3	markup factor
α	0.025	growth rate in productivity
β	0.02	growth rate in labour force
γ	0.8	money illusion coefficient
δ	0.03	depreciation rate
η	0.35	inflation relaxation parameter
ν	3	capital to output ratio

Table: Baseline parameters

Convergence in a Keen model without monetary policy (moderate initial debt)

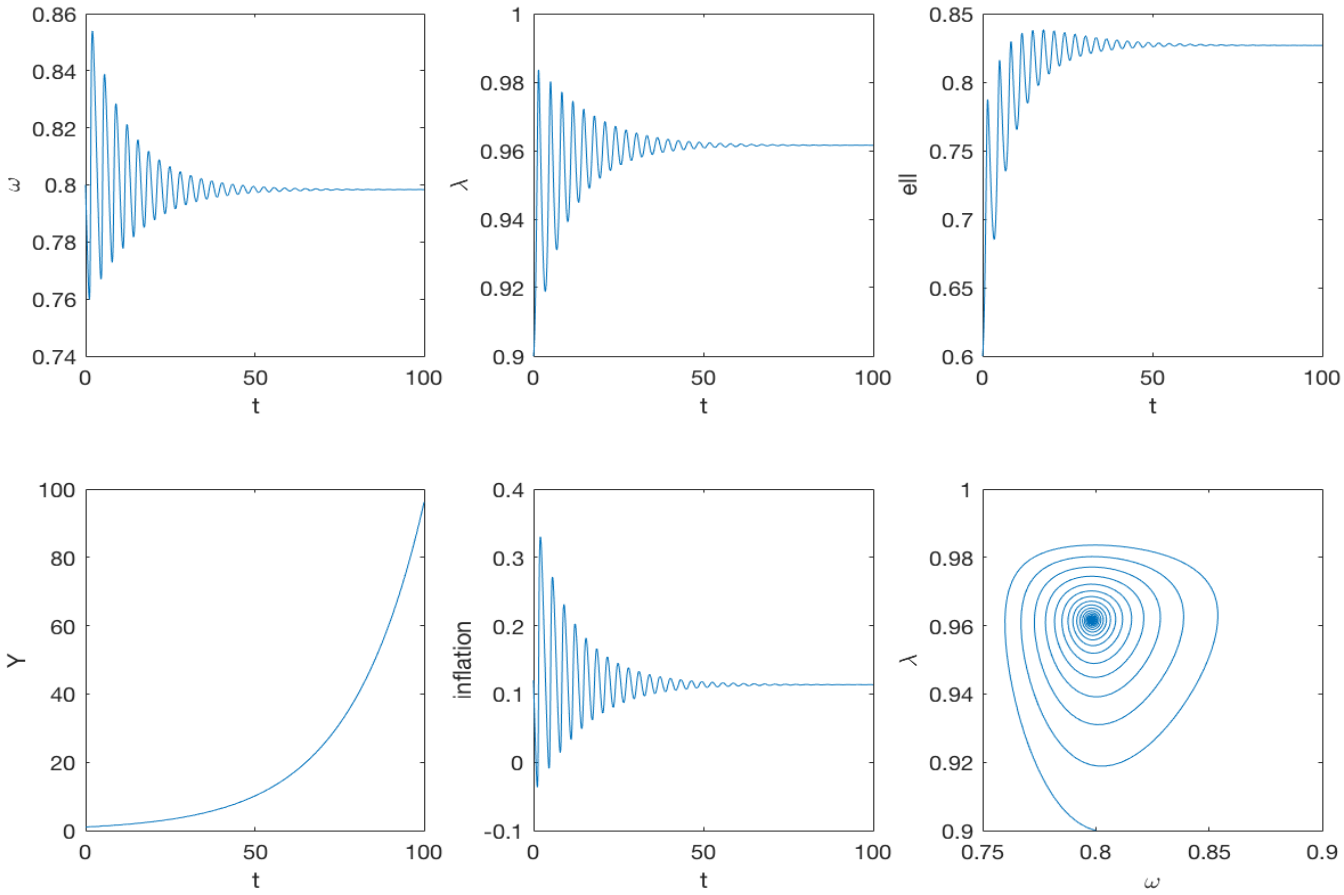
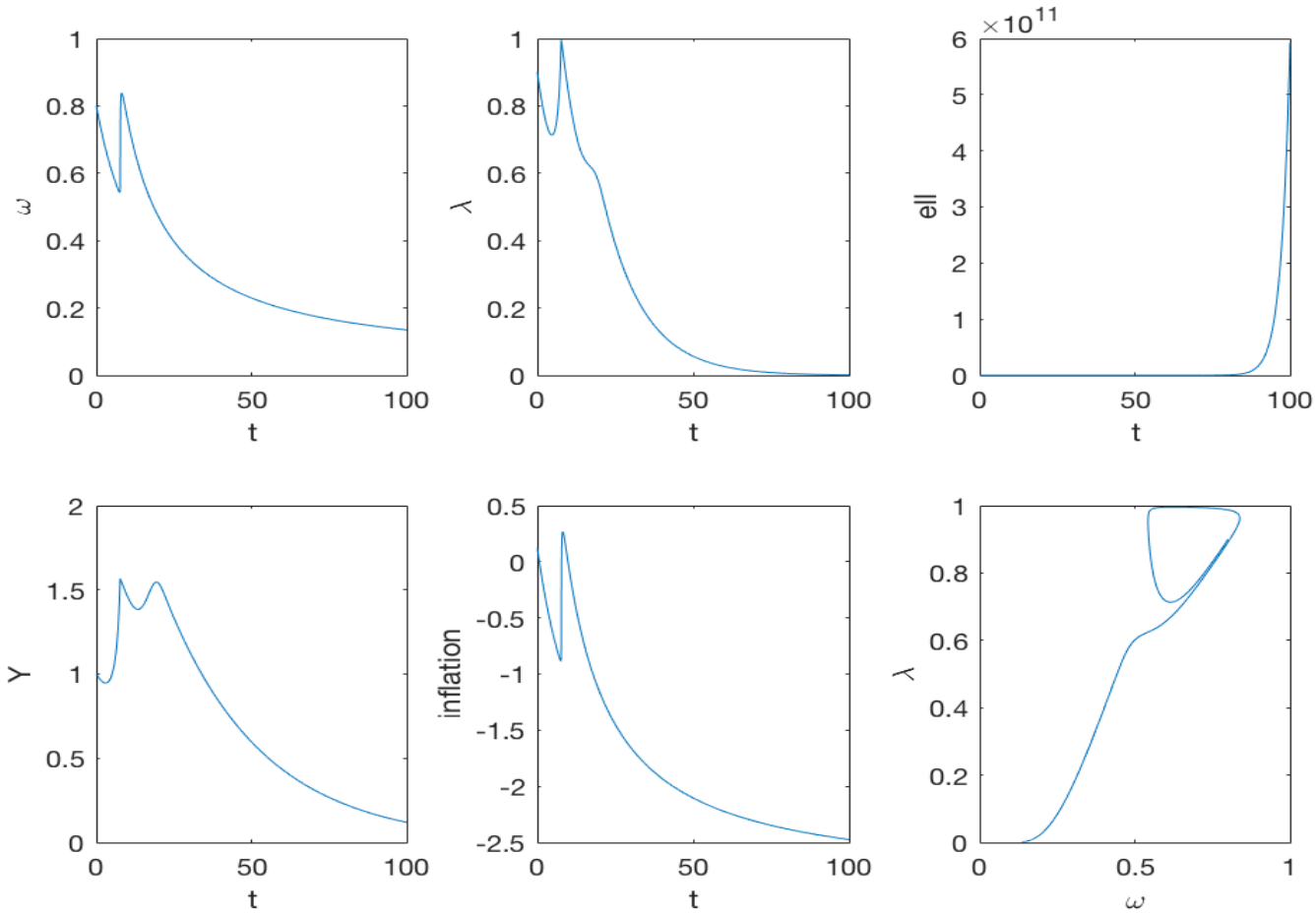


Figure: $\ell_0 = 0.6$, $g = t = \eta_r = \eta_g = 0$ and $r = 0.03$.

Explosive behaviour in a Keen model without monetary policy (high initial debt)



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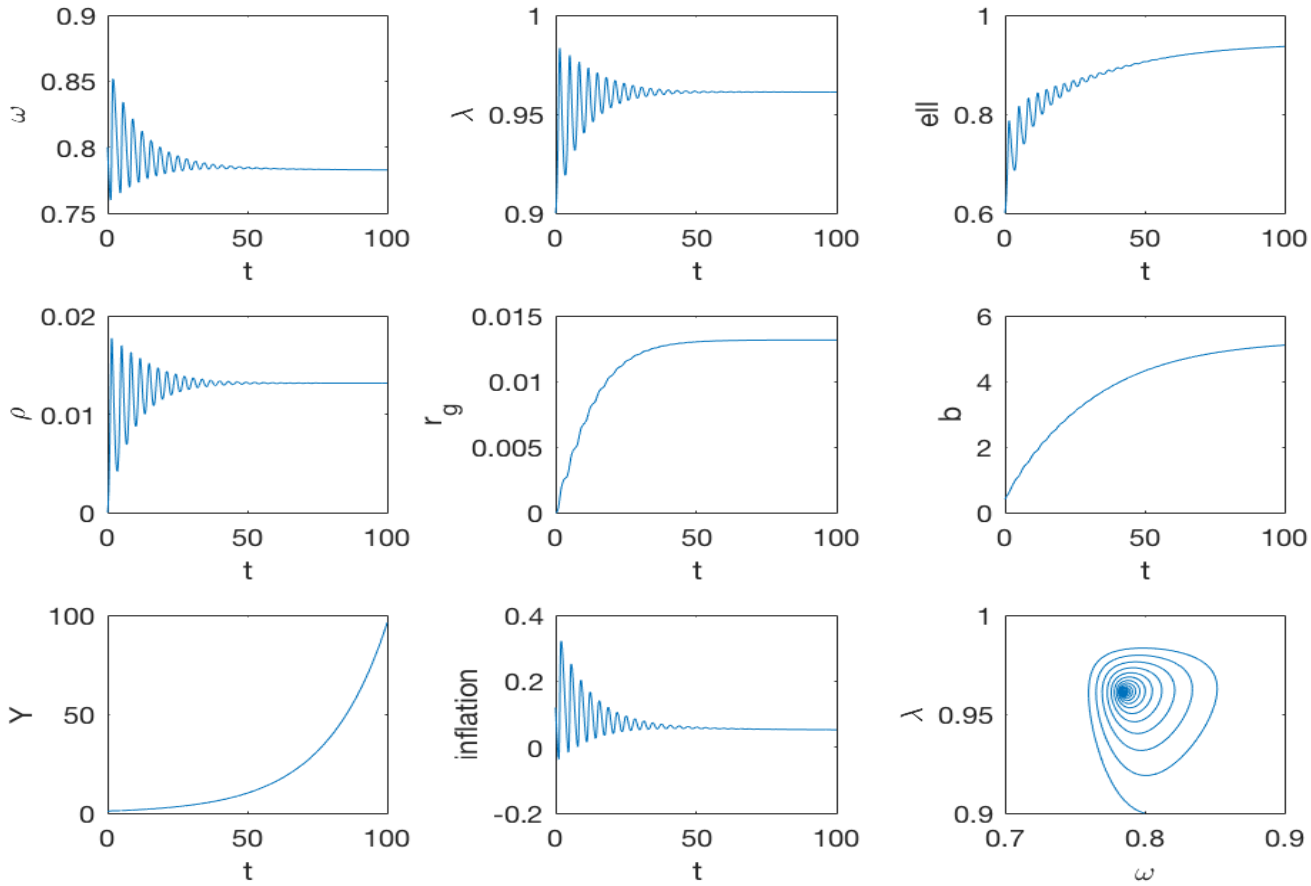

Figure: $\ell_0 = 0.6$, $g = 0.2$, $t = 0$, $\delta_r = 0.03$, $\eta_r = 0.1$ and $\eta_g = 0.2$.

Stabilizing monetary policy (high initial debt)

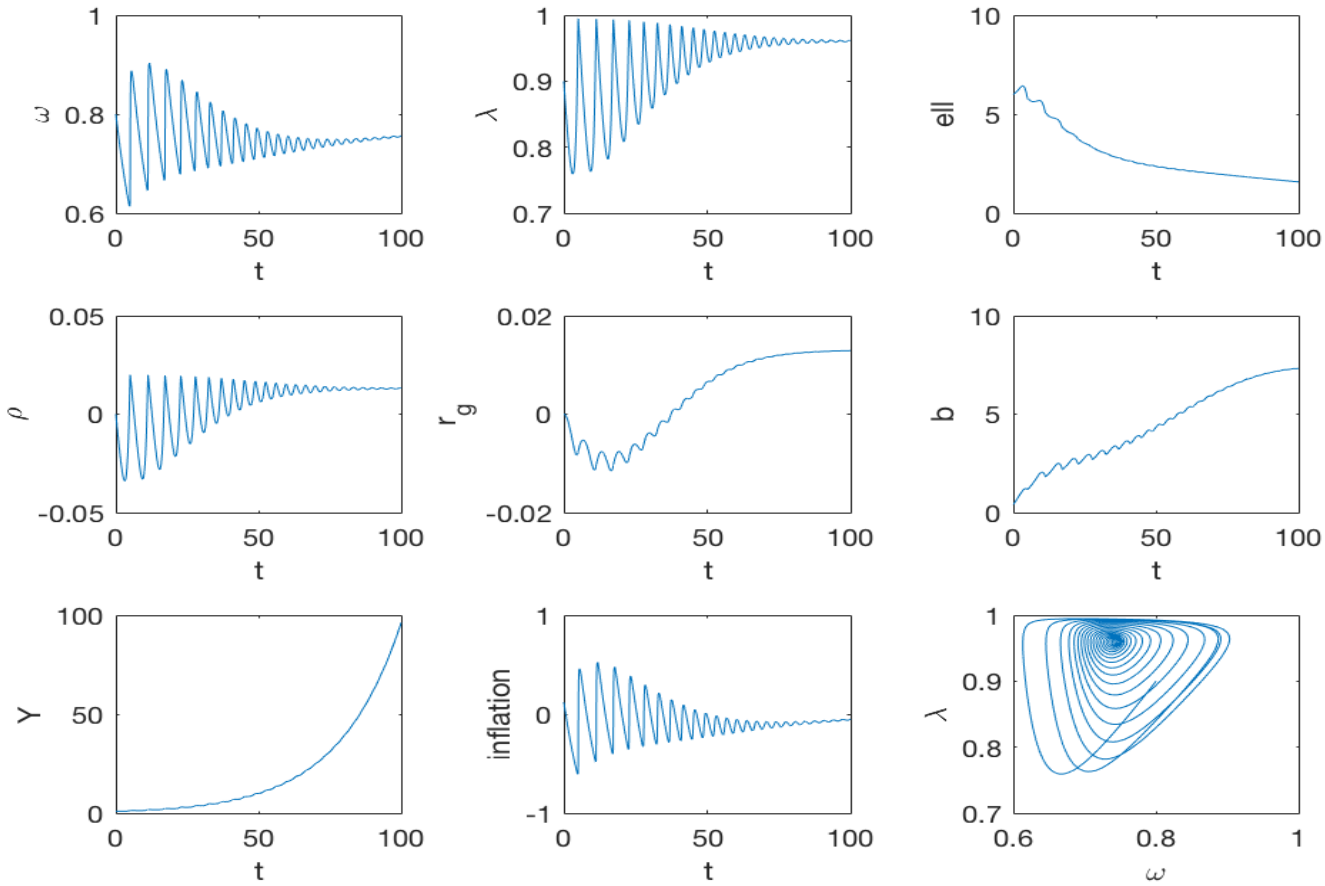

Figure: $\ell_0 = 6$, $g = 0.2$, $t = 0$, $\delta_r = 0.03$, $\eta_r = 0.1$ and $\eta_g = 0.2$.

Stabilizing monetary policy (even higher initial debt)

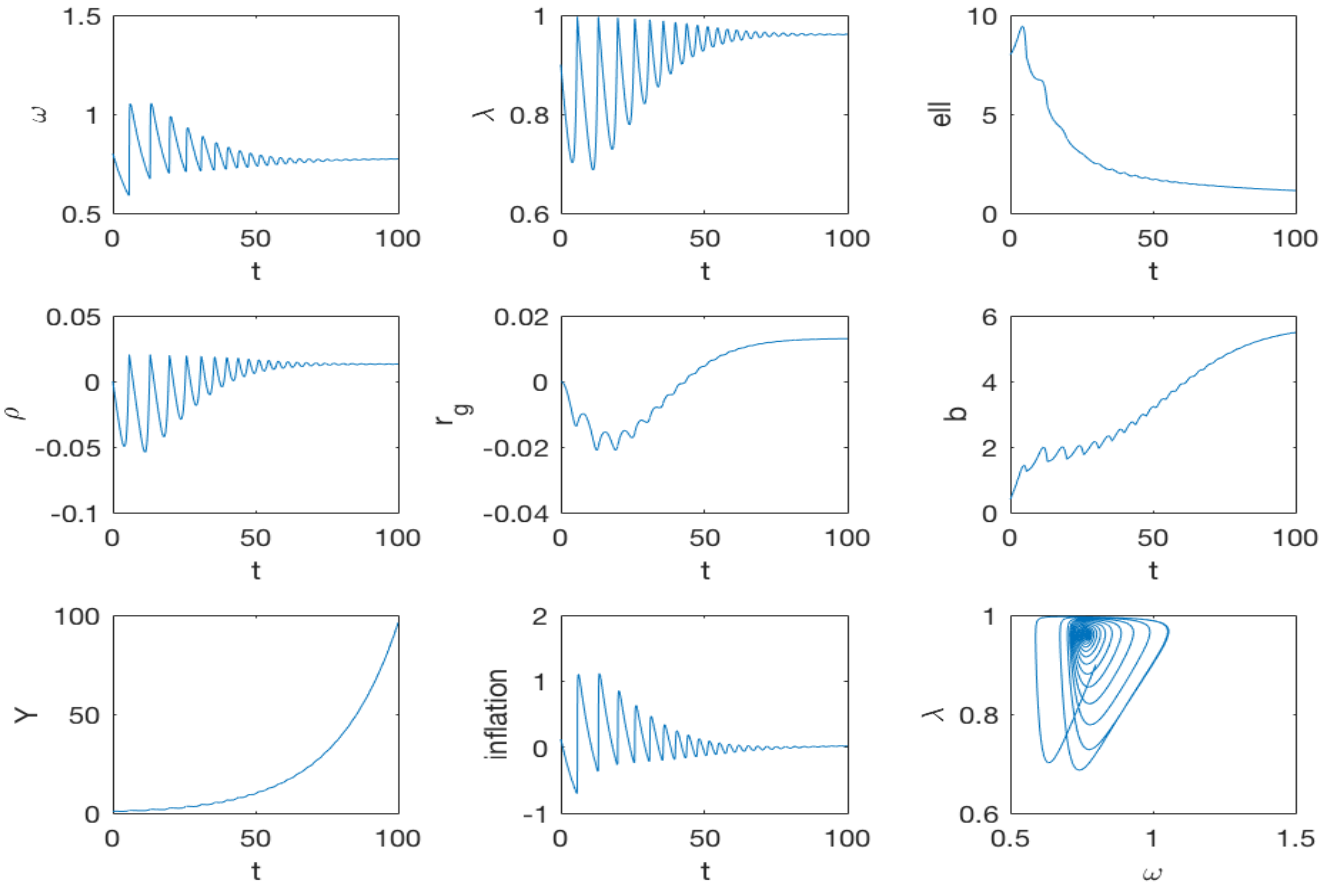

Figure: $\ell_0 = 8$, $g = 0.2$, $t = 0$, $\delta_r = 0.03$, $\eta_r = 0.1$ and $\eta_g = 0.2$.

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  3. abolishing cash: electronic currency issued by the central bank (Rogoff (2014), Barrdear and Kumhof (2016)).

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- Enter cryptocurrencies: see Lipton (2016, 2017).

Conclusions

- There is nothing special about negative interest rates.
- The existence of cash imposes a physical lower bound.
- This restricts governments to modestly negative rates, with correspondingly modest results.
- Fighting economic crises requires a multitude of tools and approaches.
- Dismissing negative rates as either absurd or ineffective seems counterproductive.
- Timid experimentation, however, only leads to confusion.

Thank you!