Some Evidence on Secular Drivers of U.S. Safe Real Rates

Kurt G. Lunsford
Federal Reserve Bank of Cleveland

Kenneth D. West
University of Wisconsin

December 2017
Last revised: September 2018

APPENDIX 1

This appendix includes:

•Some derivations omitted from the text to save space: A1: derivation of (2.4); A2: derivation of asymptotic standard errors on the estimate of ρ^{MA}.

•Tables A3, A4. Expanded versions of Tables 3 and 4, which present 90% as well as 68% confidence intervals, and includes long run correlations for some correlates omitted from the paper to save space. See notes below.

•Table A5. Estimates of the intertemporal IS using low frequency data.

•Tables A6, A7: Summary statistics on the correlates, 1890-2016 (Table A6) and 1950-2016 (Table A7).

Notes on Tables A3 and A4:

1. For correlates that are in Tables 3 and 4, the point estimates and 68 percent confidence intervals are identical to the values in Tables 3 and 4. The second interval is the asymptotic 90% confidence interval. "*" and "**" indicate that the 68% and 90% intervals do not include zero.

2. In Tables A3, and A4 row numbers in the far left of a row are identical to those in Tables 3 and 4. There is no row number at the far left if the correlate is new to this appendix.

4. Data sources are the same as those stated in the paper (e.g., the source for world demographic variables, including the ones omitted from the paper to save space, was The UN's *World Population Prospects*). Only one of the variables new to this appendix came from a new data source: World debt/GDP was obtained from Abbas et al. (2014), and runs 1900-2011.

5. To prevent confusion: as noted in the text, the correlate labeled "Federal deficit" in Tables 3 and 4 is the primary deficit. In Tables A3 and A4, for clarity we have relabeled this "Federal primary deficit," and label the total deficit (including interest payments) "Federal total deficit".

Additional reference:

Abbas S. M. Ali, Laura Blattner, Mark De Broeck, Asmaa El-Ganainy and Malin Hu , 2014, "Sovereign Debt Composition in Advanced Economies : A Historical Perspective," working paper, International Monetary Fund.

A1: Derivation of (2.4)

Derivation of (2.4): The intertermporal marginal rate of substitution is (Campbell et al. (1997,p319))

$$\text{IMRS} = \beta^{\theta}(R_{mt+1})^{\theta-1}(C_{t+1}/C_t)^{-\theta/\psi} \equiv \beta^{\theta}S_{t+1}.$$

Let $\equiv s_{t+1} \equiv \ln(S_{t+1})$. Then

(A1.1) $s_{t+1} = (\theta-1)r_{mt+1} - (\theta/\psi)\Delta c_{t+1}$.

The FOCs for a nominally safe asset and for the market portfolio are

$$1 = \beta^{\theta}E_t[S_{t+1}(1+i_t)(P_{t+1}/P_t)^{-1}],\ 1 = \beta^{\theta}E_t[S_{t+1}R_{mt+1}].$$

Log linearizing the rhs and taking log of lhs of each:

(A1.2) $0 = \theta\ln\beta + E_t s_{t+1} + 0.5\text{var}_t s_{t+1} + \ln(1+i_t) - E_t\pi_{t+1} + 0.5\text{var}_t\pi_{t+1} - \text{cov}_t(s_{t+1},\pi_{t+1})$,

(A1.3) $0 = \theta\ln\beta + E_t s_{t+1} + 0.5\text{var}_t s_{t+1} + E_t r_{mt+1} + 0.5\text{var}_t r_{mt+1} + \text{cov}_t(s_{t+1},r_{mt+1})$.

Subtract (A1.2) from (A1.3) and rearrange

(A1.4) $E_t r_{mt+1} = \ln(1+i_t) - E_t\pi_{t+1} - 0.5\text{var}_t r_{mt+1} - \text{cov}_t(s_{t+1},r_{mt+1}) + 0.5\text{var}_t\pi_{t+1} - \text{cov}_t(s_{t+1},\pi_{t+1})$.

Using the equation (A1.1) definition of s_{t+1} in the $\text{cov}_t(s_{t+1},r_{mt+1})$ term, (A1.4) becomes

(A1.5) $E_t r_{mt+1} = \ln(1+i_t) - E_t\pi_{t+1} - 0.5\text{var}_t r_{mt+1} + (1-\theta)\text{var}_t r_{mt+1} + (\theta/\psi)\text{cov}_t(\Delta c_{t+1}, r_{mt+1})$
$+ 0.5\text{var}_t\pi_{t+1} - \text{cov}_t(s_{t+1},\pi_{t+1})$.

Now write out (A1.2) in detail

(A1.6) $0 = \theta\ln\beta + (\theta-1)E_t r_{mt+1} - (\theta/\psi)E_t\Delta c_{t+1}$
$+ 0.5(\theta-1)^2\text{var}_t r_{mt+1} + 0.5(\theta/\psi)^2\text{var}_t\Delta c_{t+1} - (\theta-1)(\theta/\psi)\text{cov}_t(\Delta c_{t+1}, r_{mt+1})$
$+ \ln(1+i_t) - E_t\pi_{t+1} + 0.5\text{var}_t\pi_{t+1} - \text{cov}_t(s_{t+1},\pi_{t+1})$.

Here

(A1.7) $\text{cov}_t(s_{t+1},\pi_{t+1}) = (\theta-1)\text{cov}_t(r_{mt+1},\pi_{t+1}) - (\theta/\psi)\text{cov}_t(\Delta c_{t+1},\pi_{t+1})$.

Rearrange (A1.6):

$$\text{(A1.8)}\quad \ln(1+i_t) - E_t\pi_{t+1} = -\theta\ln\beta + (1-\theta)E_t r_{mt+1} + (\theta/\psi)E_t\Delta c_{t+1}$$
$$- 0.5(\theta-1)^2 \text{var}_t r_{mt+1} - 0.5(\theta/\psi)^2 \text{var}_t\Delta c_{t+1} + (\theta-1)(\theta/\psi)\text{cov}_t(\Delta c_{t+1}, r_{mt+1})$$
$$- \ 0.5\text{var}_t\pi_{t+1} + \text{cov}_t(s_{t+1},\pi_{t+1}).$$

Use (A1.5) to substitute out for $E_t r_{mt+1}$. After some rearrangement, the result is

$$\text{(A1.9)}\quad \theta\,[\ln(1+i_t) - E_t\pi_{t+1}] = -\theta\ln\beta + \tfrac{1}{2}\,\theta(\theta-1)\text{var}_t r_{mt+1} - \ 0.5\theta\text{var}_t\pi_{t+1} + (\theta/\psi)E_t\Delta c_{t+1} - 0.5(\theta/\psi)^2\text{var}_t\Delta c_{t+1}$$
$$+ \theta\ \text{cov}_t(s_{t+1},\pi_{t+1}).$$

After dividing both sides by θ and using (A1.7), the result is (2.4) in the text.

A2 Derivation of asymptotic standard errors on the estimate of ρ^{MA}

Apart from symbols with superscript *MA*, notation in this section may not match notation elsewhere in this appendix or in the paper.

For a given correlate x_t, let μ_r, μ_x, γ_r and γ_x denote the means and variances of r_t^{MA} and x_t^{MA}, with $\gamma_{rx} \equiv \text{cov}(r_t^{MA}, x_t^{MA})$. Thus

(A2.1) $$\rho^{MA} = \gamma_{rx} / (\gamma_r \gamma_x)^{½}.$$

Let

(A2.2) $$\theta \equiv (\mu_r, \mu_x, \gamma_r, \gamma_x, \gamma_{rx})'.$$

Write (A2.1) as

(A2.3) $$\rho^{MA} = f(\theta)$$

where the function f:$\mathbf{R}^5 \to \mathbf{R}$ is defined on the r.h.s. of (A2.1).

Let S be the 5×5 asymptotic variance-covariance matrix of estimates of θ. (S is derived below.) Then the asymptotic variance of the estimate of ρ^{MA} is

(A2.4) $$(\partial f/\partial\theta)' S (\partial f/\partial\theta).$$

Here, $(\partial f/\partial\theta)'$is 1×5. The standard error on the estimate of ρ^{MA} was computed by evaluating $\partial f/\partial\theta$ at sample moments and using an estimate of S that is about to be described.

Derivation of S: The following 5×1 orthogonality condition was used to estimate θ:

(A2.5) $$Eh_t(\theta) = 0,\ h_t(\theta) = [r_t^{MA}-\mu_r,\ x_t^{MA}-\mu_x,\ (r_t^{MA}-\mu_r)^2-\gamma_r,\ (x_t^{MA}-\mu_x)^2-\gamma_x,\ (r_t^{MA}-\mu_r)(x_t^{MA}-\mu_x)-\gamma_{rx}]'.$$

$\hat{\theta}$ was constructed by setting $T^{-1}\sum_{t=1}^{T} h_t(\hat{\theta})=0$–that is, $\hat{\theta}$ was constructed in the usual way, e.g., $\hat{\mu}_r = T^{-1}\sum_{t=1}^{T} r_t^{MA}$.

Then under suitable conditions $\sqrt{T}(\hat{\theta}-\theta)$ is asymptotically normally with variance-covariance matrix

(A2.6) $$(E\partial h_t/\partial\theta)^{-1} \times (\text{long run variance of } h_t) \times (E\partial h_t/\partial\theta)^{-1\prime} \equiv S.$$

Since $E\partial h_t/\partial\theta = -I_5$, this means $\sqrt{T}(\hat{\theta}-\theta)$ is asympotically normal with S = long run variance of h_t.

This long run variance was estimated using Newey and West (1994). The Bartlett kernel was used. To obtain the bandwidth, Newey and West's weight vector w was set to $(0\ 0\ 1\ 1\ 1)'$ and the parameter that Newey and West (1994) call n was set to $4(T/100)^{2/9}$.

In early work, we did some experimentation with the resulting bandwidth, checking whether results were sensitive to modest increases or decreases in the value produced by the algorithm described in the preceding paragraph. There was little sensitivity.

A3. Expanded Table 3

Long run correlations, 1890-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(1a)	GDP growth (+)	-0.15	0.01	0.00	-0.02	0.04	-0.01	0.20	0.04
		(-0.31,0.01)	(-0.19,0.20)		(-0.19,0.13)			(-0.01,0.38)	
		(-0.42,0.12)	(-0.32,0.33)		(-0.41,0.32)			(-0.14,0.49)	
(1b)	Consumption growth (+)	0.06	0.04	0.00	0.03	0.03	0.04	-0.01	0.00
		(-0.11,0.23)	(-0.16,0.23)		(-0.13,0.14)			(-0.21,0.19)	
		(-0.22,0.34)	(-0.29,0.36)		(-0.26,0.38)			(-0.33,0.32)	
(1c)	World GDP growth (+)	0.09	0.18	0.03	0.12	0.06	0.10	0.26*	0.07
		(-0.06,0.24)	(-0.02,0.36)		(-0.06,0.34)			(0.06,0.43)	
		(-0.16,0.34)	(-0.15,0.47)		(-0.21,0.46)			(-0.08,0.53)	
(1d)	TFP growth (+)	-0.55**	-0.36**	0.13	-0.31*	0.14	-0.33*	-0.01	0.00
		(-0.64,-0.45)	(-0.52,-0.17)		(-0.50,-0.08)			(-0.21,0.19)	
		(-0.70,-0.39)	(-0.61,-0.03)		(-0.75,0.03)			(-0.33,0.31)	
	Labor productivity growth	-0.57**	-0.39**	0.16	-0.30*	0.14	-0.32*	-0.11	0.01
		(-0.69,-0.45)	(-0.54,-0.21)		(-0.50,-0.08)			(-0.30,0.09)	
		(-0.77,-0.37)	(-0.63,-0.08)		(-0.80,0.05)			(-0.41,0.22)	
(2a)	var_t(GDP growth) (-)	-0.62**	-0.49**	0.24	-0.30*	0.12	-0.32*	-0.23*	0.05
		(-0.78,-0.46)	(-0.62,-0.31)		(-0.65,-0.10)			(-0.41,-0.03)	
		(-0.88,-0.35)	(-0.70,-0.19)		(-0.70,0.20)			(-0.51,0.11)	
	var_t(C growth) (-)	-0.61**	-0.43**	0.18	-0.26*	0.11	-0.26*	-0.19	0.04
		(-0.76,-0.46)	(-0.58,-0.22)		(-0.60,-0.03)			(-0.39,0.03)	
		(-0.86,-0.36)	(-0.67,-0.08)		(-0.70,0.20)			(-0.50,0.17)	
(2b)	var_t(π_GDP) (-)	-0.17*	-0.04	0.00	0.11	0.08	0.10	0.26*	0.07
		(-0.29,-0.03)	(-0.24,0.16)		(-0.40,0.39)			(0.06,0.43)	
		(-0.38,0.05)	(-0.36,0.29)		(-0.60,0.65)			(-0.08,0.53)	
	var_t(π_PCE) (-)	-0.17	-0.04	0.00	0.09	0.07	0.06	0.25*	0.06
		(-0.35,0.02)	(-0.25,0.18)		(-0.35,0.34)			(0.03,0.44)	
		(-0.47,0.14)	(-0.39,0.32)		(-0.50,0.65)			(-0.12,0.55)	

A3. Expanded Table 3, continued

Long run correlations, 1890-2016

(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(2c) var_t(mkt return) (-)	-0.59**	-0.51**	0.26	-0.35*	0.17	-0.44*	-0.19	0.04
	(-0.73,-0.46)	(-0.64,-0.34)		(-0.75,-0.11)			(-0.37,0.02)	
	(-0.82,-0.35)	(-0.71,-0.21)		(-0.85,0.01)			(-0.48,0.15)	
var_t(mkt return) (PCE defl.) (-)	-0.55**	-0.46**	0.21	-0.33*	0.15	-0.39*	-0.25*	0.06
	(-0.69,-0.40)	(-0.61,-0.26)		(-0.65,-0.11)			(-0.44,-0.03)	
	(-0.79,-0.30)	(-0.70,-0.12)		(-0.80,0.20)			(-0.55,0.11)	
(3a) cov_t(π_GDP,GDP growth) (-)	-0.42**	-0.31*	0.10	-0.18	0.11	-0.23	0.10	0.01
	(-0.57,-0.26)	(-0.47,-0.11)		(-0.60,0.08)			(-0.10,0.29)	
	(-0.67,-0.16)	(-0.57,0.02)		(-0.70,0.45)			(-0.23,0.41)	
cov_t(π_PCE,C growth) (-)	-0.66**	-0.49**	0.24	-0.33*	0.16	-0.41*	-0.13	0.02
	(-0.78,-0.55)	(-0.63,-0.29)		(-0.70,-0.11)			(-0.34,0.09)	
	(-0.85,-0.47)	(-0.71,-0.15)		(-0.85,0.03)			(-0.46,0.23)	
(3b) cov_t(π_GDP,mkt return) (-)	0.02	-0.08	0.01	-0.18	0.09	-0.20	-0.35**	0.12
	(-0.14,0.18)	(-0.28,0.13)		(-0.42,0.40)			(-0.51,-0.14)	
	(-0.24,0.29)	(-0.40,0.26)		(-0.75,0.60)			(-0.60,-0.01)	
cov_t(π_PCE, mkt return) (-)	-0.58*	-0.19	0.04	-0.21	0.10	-0.23	-0.25*	0.06
	(-0.72,-0.44)	(-0.39,0.03)		(-0.55,0.20)			(-0.44,-0.03)	
	(-0.81,-0.35)	(-0.50,0.18)		(-0.75,0.40)			(-0.55,0.12)	
(4a) Labor hours growth (+)	0.31*	0.27*	0.07	0.24*	0.09	0.23*	0.24*	0.07
	(0.09,0.53)	(0.07,0.44)		(0.05,0.43)			(0.04,0.42)	
	(-0.06,0.67)	(-0.07,0.54)		(-0.10,0.50)			(-0.09,0.52)	
(4b) Growth in capital per hour (-)	0.23*	0.13	0.02	0.12	0.05	0.10	-0.15	0.02
	(0.07,0.39)	(-0.07,0.32)		(-0.05,0.34)			(-0.34,0.05)	
	(-0.03,0.49)	(-0.20,0.44)		(-0.16,0.43)			(-0.45,0.18)	
Growth in capital per capita (-)	0.67**	0.60**	0.36	0.49**	0.27	0.50**	0.25*	0.06
	(0.59,0.75)	(0.44,0.71)		(0.30,0.65)			(0.05,0.42)	
	(0.53,0.80)	(0.33,0.77)		(0.16,0.90)			(-0.08,0.53)	

A3. Expanded Table 3, continued

Long run correlations, 1890-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(5a)	Dependency ratio (+)	0.36**	0.38**	0.14	0.25*	0.09	0.23*	0.17	0.03
		(0.17,0.56)	(0.18,0.53)		(0.10,0.65)			(-0.03,0.35)	
		(0.04,0.68)	(0.05,0.62)		(-0.15,0.70)			(-0.17,0.47)	
(5b)	Percent aged 40-64 (-)	-0.43**	-0.43**	0.19	-0.26**	0.08	-0.23**	-0.24*	0.06
		(-0.61,-0.25)	(-0.58,-0.25)		(-0.55,-0.23)			(-0.42,-0.04)	
		(-0.72,-0.14)	(-0.66,-0.12)		(-0.55,-0.10)			(-0.52,0.10)	
	MY ratio (-)	-0.34**	-0.31*	0.10	-0.14	0.08	-0.23	-0.01	0.00
		(-0.51,-0.16)	(-0.48,-0.12)		(-0.55,0.10)			(-0.21,0.19)	
		(-0.62,-0.05)	(-0.57,0.02)		(-0.70,0.40)			(-0.33,0.32)	
	ΔDependency ratio (-)	-0.47**	-0.43**	0.19	-0.29*	0.13	-0.32*	-0.25*	0.06
		(-0.58,-0.37)	(-0.58,-0.25)		(-0.80,-0.04)			(-0.42,-0.05)	
		(-0.64,-0.30)	(-0.66,-0.12)		(-0.85,0.45)			(-0.52,0.09)	
(5c)	ΔPercent aged 40-64 (+)	0.14	0.18	0.03	0.19	0.10	0.22	0.11	0.01
		(0.00,0.27)	(-0.02,0.37)		(-0.03,0.70)			(-0.10,0.30)	
		(-0.08,0.35)	(-0.16,0.48)		(-0.50,0.80)			(-0.23,0.41)	
	ΔMY ratio (+)	0.02	0.05	0.00	0.04	0.08	0.00	-0.06	0.00
		(-0.13,0.18)	(-0.15,0.25)		(-0.40,0.60)			(-0.26,0.14)	
		(-0.24,0.29)	(-0.27,0.37)		(-0.70,0.70)			(-0.38,0.27)	
(5d)	ΔLife expectancy (-)	-0.14	0.17	0.03	0.08	0.04	0.10	0.51*	0.26
		(-0.27,0.00)	(-0.04,0.35)		(-0.13,0.21)			(0.34,0.64)	
		(-0.36,0.09)	(-0.17,0.46)		(-0.14,0.41)			(0.21,0.71)	
	Fed total deficit/GDP (+)	-0.53**	-0.47**	0.22	-0.41**	0.20	-0.42**	-0.23*	0.05
		(-0.69,-0.38)	(-0.60,-0.29)		(-0.57,-0.21)			(-0.41,-0.03)	
		(-0.79,-0.28)	(-0.68,-0.16)		(-0.71,-0.04)			(-0.51,0.10)	
(6a)	Fed primary deficit/GDP (+)	-0.56**	-0.48**	0.23	-0.43**	0.22	-0.44*	-0.25*	0.06
		(-0.68,-0.43)	(-0.61,-0.30)		(-0.59,-0.26)			(-0.42,-0.05)	
		(-0.76,-0.35)	(-0.69,-0.17)		(-0.72,-0.06)			(-0.53,0.09)	

A3. Expanded Table 3, continued

Long run correlations, 1890-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(6b)	Fed debt/GDP (+)	-0.59**	-0.57**	0.32	-0.44**	0.22	-0.46**	-0.29*	0.08
		(-0.79,-0.39)	(-0.68,-0.40)		(-0.75,-0.27)			(-0.45,-0.09)	
		(-0.91,-0.27)	(-0.75,-0.29)		(-0.85,-0.10)			(-0.56,0.04)	
	World debt/GDP (+)	-0.68**	-0.62**	0.38	-0.50**	0.29	-0.52**	-0.31*	0.10
		(-0.80,-0.55)	(-0.73,-0.46)		(-0.71,-0.30)			(-0.49,-0.10)	
		(-0.88,-0.47)	(-0.79,-0.33)		(-0.90,-0.16)			(-0.59,0.04)	
(7)	Current account/GDP (+)	-0.15	-0.18	0.03	-0.22	0.11	-0.27	-0.47**	0.22
		(-0.35,0.05)	(-0.36,0.03)		(-0.49,0.15)			(-0.61,-0.30)	
		(-0.48,0.18)	(-0.47,0.16)		(-0.64,0.45)			(-0.69,-0.17)	
(8)	Relative price inv. goods (+)	-0.01	0.07	0.01	0.12	0.08	0.10	0.17	0.03
		(-0.17,0.15)	(-0.13,0.27)		(-0.11,0.42)			(-0.03,0.36)	
		(-0.27,0.25)	(-0.25,0.38)		(-0.45,0.60)			(-0.16,0.47)	
(9)	Top 10% income share (-)	-0.03	-0.05	0.00	0.11	0.07	0.10	0.27*	0.07
		(-0.22,0.15)	(-0.27,0.17)		(-0.40,0.38)			(0.04,0.46)	
		(-0.34,0.28)	(-0.40,0.32)		(-0.50,0.50)			(-0.11,0.57)	
(10)	Baa-10 yr Treasury spread (-)	0.30*	0.21	0.04	0.17	0.10	0.18	0.22	0.05
		(0.11,0.48)	(-0.02,0.41)		(-0.20,0.47)			(-0.01,0.42)	
		(-0.01,0.60)	(-0.18,0.53)		(-0.50,0.75)			(-0.16,0.54)	
(11a)	π_GDP (-)	-0.30**	-0.43**	0.19	-0.42*	0.23	-0.46*	-0.69**	0.48
		(-0.45,-0.16)	(-0.57,-0.25)		(-0.67,-0.10)			(-0.78,-0.56)	
		(-0.54,-0.06)	(-0.66,-0.12)		(-0.73,0.25)			(-0.82,-0.46)	
(11b)	π_PCE (-)	-0.38 **	-0.48**	0.23	-0.46*	0.27	-0.50*	-0.70**	0.49
		(-0.55,-0.22)	(-0.62,-0.30)		(-0.71,-0.21)			(-0.78,-0.58)	
		(-0.65,-0.11)	(-0.69,-0.18)		(-0.79,0.30)			(-0.83,-0.48)	
(12a)	M1 growth (-)	-0.34*	-0.44**	0.20	-0.39*	0.21	-0.44*	-0.38**	0.14
		(-0.56,-0.12)	(-0.60,-0.23)		(-0.59,-0.16)			(-0.54,-0.16)	
		(-0.70,0.02)	(-0.69,-0.09)		(-0.85,0.00)			(-0.64,-0.01)	
(12b)	M2 growth (-)	-0.33**	-0.33**	0.11	-0.30*	0.14	-0.33*	-0.28*	0.08
		(-0.50,-0.16)	(-0.49,-0.14)		(-0.53,-0.05)			(-0.45,-0.08)	
		(-0.61,-0.06)	(-0.59,-0.01)		(-0.60,0.07)			(-0.55,0.05)	

A4. Expanded Table 4

Long run correlations, 1950-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(1a)	GDP growth (+)	0.61**	0.23	0.05	0.16	0.09	0.15	-0.01	0.00
		(0.48,0.74)	(-0.06,0.46)		(-0.07,0.43)			(-0.28,0.27)	
		(0.39,0.83)	(-0.25,0.60)		(-0.27,0.65)			(-0.45,0.44)	
(1b)	Consumption growth (+)	0.56**	0.46**	0.21	0.31*	0.16	0.34*	0.20	0.04
		(0.40,0.72)	(0.19,0.64)		(0.03,0.60)			(-0.09,0.44)	
		(0.29,0.83)	(0.00,0.74)		(-0.12,0.80)			(-0.27,0.58)	
(1c)	World GDP growth (+)	0.05	0.00	0.00	-0.02	0.08	-0.01	-0.15	0.02
		(-0.23,0.33)	(-0.27,0.28)		(-0.50,0.27)			(-0.40,0.14)	
		(-0.41,0.51)	(-0.44,0.44)		(-0.65,0.70)			(-0.55,0.31)	
(1d)	TFP growth (+)	-0.23*	-0.25	0.06	-0.18	0.11	-0.20	-0.38*	0.14
		(-0.46,-0.01)	(-0.49,0.04)		(-0.46,0.06)			(-0.58,-0.10)	
		(-0.61,0.14)	(-0.62,0.22)		(-0.70,0.45)			(-0.70,0.09)	
	Labor productivity growth (+)	-0.18	-0.08	0.01	-0.05	0.08	-0.03	-0.23	0.05
		(-0.43,0.07)	(-0.34,0.21)		(-0.34,0.23)			(-0.47,0.06)	
		(-0.59,0.23)	(-0.50,0.38)		(-0.65,0.60)			(-0.60,0.25)	
(2a)	var_t(C growth) (-)	-0.22	-0.40*	0.16	-0.37*	0.20	-0.40*	-0.54**	0.29
		(-0.48,0.03)	(-0.60,-0.13)		(-0.65,0.00)			(-0.70,-0.29)	
		(-0.65,0.20)	(-0.71,0.07)		(-0.85,0.35)			(-0.78,-0.10)	
	var_t(GDP growth) (-)	-0.35*	-0.38*	0.14	-0.29*	0.13	-0.27*	-0.42*	0.17
		(-0.59,-0.10)	(-0.58,-0.10)		(-0.50,-0.10)			(-0.61,-0.14)	
		(-0.75,0.06)	(-0.69,0.09)		(-0.70,0.05)			(-0.72,0.04)	
(2b)	var_t(π_NDS) (-)	-0.16	-0.31*	0.10	-0.23	0.11	-0.27	-0.20	0.04
		(-0.43,0.12)	(-0.53,-0.03)		(-0.60,0.00)			(-0.45,0.08)	
		(-0.62,0.30)	(-0.65,0.16)		(-0.75,0.23)			(-0.59,0.27)	
	var_t(π_GDP) (-)	-0.28*	-0.33*	0.11	-0.23*	0.11	-0.27*	-0.28	0.08
		(-0.54,-0.02)	(-0.54,-0.05)		(-0.50,0.00)			(-0.50,0.01)	
		(-0.71,0.14)	(-0.66,0.14)		(-0.70,0.18)			(-0.63,0.20)	

A4. Expanded Table 4, continued

Long run correlations, 1950-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(2c)	var_t(mkt return) (-)	-0.34*	-0.59**	0.34	-0.48*	0.28	-0.50*	-0.52**	0.27
		(-0.58,-0.11)	(-0.73,-0.35)		(-0.80,-0.27)			(-0.68,-0.26)	
		(-0.73,0.05)	(-0.81,-0.17)		(-0.91,0.10)			(-0.77,-0.07)	
	var_t(mkt return) (GDP defl.) (-)	-0.43**	-0.62**	0.38	-0.48*	0.29	-0.50*	-0.50**	0.25
		(-0.64,-0.22)	(-0.75,-0.39)		(-0.80,-0.27)			(-0.67,-0.24)	
		(-0.78,-0.09)	(-0.82,-0.21)		(-0.91,0.10)			(-0.76,-0.05)	
(3a)	cov_t(π_NDS,C growth) (-)	-0.76**	-0.64**	0.41	-0.45**	0.25	-0.46**	-0.37*	0.14
		(-0.83,-0.69)	(-0.77,-0.42)		(-0.80,-0.23)			(-0.58,-0.09)	
		(-0.87,-0.64)	(-0.84,-0.25)		(-0.91,0.00)			(-0.69,0.10)	
	cov_t(π_GDP,GDP growth) (-)	-0.24*	-0.36*	0.13	-0.25	0.13	-0.29	-0.06	0.00
		(-0.42,-0.06)	(-0.57,-0.08)		(-0.65,0.00)			(-0.33,0.21)	
		(-0.53,0.06)	(-0.68,0.11)		(-0.85,0.18)			(-0.49,0.39)	
(3b)	cov_t(π_NDS,mkt return) (-)	-0.27	0.02	0.00	0.15	0.10	0.16	0.31*	0.10
		(-0.54,0.00)	(-0.25,0.30)		(-0.30,0.46)			(0.02,0.53)	
		(-0.72,0.17)	(-0.42,0.46)		(-0.55,0.70)			(-0.16,0.65)	
	cov_t(π_GDP,mkt return) (-)	0.016	0.10	0.01	0.13	0.09	0.10	0.22	0.05
		(-0.32,0.35)	(-0.19,0.36)		(-0.20,0.45)			(-0.07,0.46)	
		(-0.54,0.57)	(-0.36,0.52)		(-0.55,0.70)			(-0.25,0.59)	
(4a)	Labor hours growth (+)	0.81**	0.38*	0.15	0.36*	0.20	0.40*	0.11	0.01
		(0.76,0.87)	(0.10,0.58)		(0.06,0.65)			(-0.17,0.37)	
		(0.72,0.90)	(-0.09,0.69)		(-0.08,0.77)			(-0.35,0.52)	
(4b)	Growth in capital per hour (-)	0.10	0.34*	0.11	0.24	0.12	0.27	0.27	0.07
		(-0.14,0.33)	(0.05,0.55)		(-0.01,0.50)			(-0.02,0.50)	
		(-0.29,0.48)	(-0.14,0.67)		(-0.18,0.70)			(-0.21,0.63)	
	Growth in capital per capita (-)	0.77**	0.72**	0.51	0.57**	0.37	0.60**	0.51**	0.26
		(0.68,0.86)	(0.53,0.82)		(0.36,0.80)			(0.26,0.68)	
		(0.62,0.92)	(0.38,0.87)		(0.16,0.93)			(0.07,0.77)	

A4. Expanded Table 4, continued

Long run correlations, 1950-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(5a)	Dependency ratio (+)	-0.04	0.10	0.01	0.13	0.09	0.11	0.13	0.02
		(-0.30,0.23)	(-0.18,0.36)		(-0.11,0.50)			(-0.16,0.39)	
		(-0.47,0.40)	(-0.36,0.52)		(-0.50,0.70)			(-0.34,0.54)	
(5b)	Dependency ratio, world (+)	0.00	0.08	0.01	0.08	0.06	0.10	0.08	0.01
		(-0.27,0.26)	(-0.21,0.34)		(-0.23,0.32)			(-0.21,0.34)	
		(-0.44,0.43)	(-0.38,0.50)		(-0.33,0.55)			(-0.38,0.50)	
(5c)	Percent aged 40-64 (-)	-0.62**	-0.54**	0.29	-0.28*	0.12	-0.27*	-0.25	0.06
		(-0.79,-0.45)	(-0.70,-0.29)		(-0.65,-0.10)			(-0.48,0.04)	
		(-0.90,-0.34)	(-0.78,-0.11)		(-0.80,0.10)			(-0.61,0.23)	
(5d)	Percent aged 40-64,world (-)	-0.41**	-0.40*	0.16	-0.21	0.09	-0.23	-0.18	0.03
		(-0.64,-0.18)	(-0.60,-0.12)		(-0.55,0.00)			(-0.43,0.10)	
		(-0.79,-0.03)	(-0.71,0.07)		(-0.75,0.23)			(-0.57,0.29)	
	MY ratio (-)	-0.52**	-0.35*	0.12	-0.07	0.08	-0.03	0.05	0.00
		(-0.70,-0.35)	(-0.56,-0.07)		(-0.60,0.23)			(-0.23,0.32)	
		(-0.81,-0.24)	(-0.68,0.12)		(-0.75,0.55)			(-0.40,0.48)	
	MY ratio, world (-)	-0.52**	-0.45*	0.20	-0.17	0.09	-0.23	-0.03	0.00
		(-0.71,-0.32)	(-0.64,-0.18)		(-0.55,0.10)			(-0.30,0.25)	
		(-0.84,-0.19)	(-0.74,0.01)		(-0.75,0.27)			(-0.46,0.42)	
	ΔDependency ratio (-)	-0.45**	-0.49**	0.24	-0.28*	0.14	-0.30*	-0.22	0.05
		(-0.62,-0.29)	(-0.67,-0.23)		(-0.75,0.00)			(-0.46,0.07)	
		(-0.73,-0.18)	(-0.76,-0.04)		(-0.85,0.30)			(-0.60,0.26)	
	ΔDependency ratio, world (-)	-0.65**	-0.68**	0.46	-0.48*	0.28	-0.49*	-0.55**	0.30
		(-0.78,-0.52)	(-0.79,-0.47)		(-0.80,-0.27)			(-0.70,-0.30)	
		(-0.87,-0.44)	(-0.86,-0.31)		(-0.90,0.05)			(-0.79,-0.11)	
(5e)	ΔPercent aged 40-64 (+)	0.18	0.33*	0.11	0.28*	0.14	0.30*	0.32*	0.11
		(-0.01,0.36)	(0.04,0.55)		(0.01,0.70)			(0.04,0.54)	
		(-0.12,0.48)	(-0.14,0.67)		(-0.45,0.80)			(-0.15,0.66)	

A4. Expanded Table 4, continued

Long run correlations, 1950-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(5f)	ΔPercent aged 40-64, world (+)	0.20	0.24	0.06	0.18	0.11	0.19	0.14	0.02
		(-0.01,0.42)	(-0.04,0.48)		(-0.07,0.55)			(-0.15,0.39)	
		(-0.15,0.56)	(-0.23,0.61)		(-0.50,0.80)			(-0.33,0.54)	
(5g)	ΔLife expectancy (-)	-0.23*	-0.33*	0.11	-0.32	0.17	-0.36	-0.59**	0.35
		(-0.37,-0.08)	(-0.54,-0.04)		(-0.60,0.15)			(-0.73,-0.35)	
		(-0.47,0.01)	(-0.66,0.15)		(-0.75,0.45)			(-0.81,-0.18)	
	ΔMY ratio (+)	0.36**	0.22	0.05	0.09	0.09	0.10	0.04	0.00
		(0.17,0.55)	(-0.07,0.46)		(-0.21,0.60)			(-0.24,0.31)	
		(0.05,0.67)	(-0.25,0.60)		(-0.60,0.75)			(-0.41,0.47)	
	ΔMY ratio, world (+)	0.35**	0.29*	0.08	0.20	0.11	0.21	0.21	0.04
		(0.20,0.49)	(0.00,0.51)		(-0.04,0.50)			(-0.08,0.45)	
		(0.11,0.58)	(-0.19,0.64)		(-0.55,0.80)			(-0.26,0.59)	
	Fed total deficit/GDP (+)	0.05	-0.04	0.00	-0.05	0.08	-0.03	-0.09	0.01
		(-0.32,0.42)	(-0.30,0.24)		(-0.36,0.27)			(-0.36,0.19)	
		(-0.55,0.66)	(-0.47,0.41)		(-0.70,0.65)			(-0.51,0.37)	
(6a)	Fed primary deficit/GDP (+)	-0.26	-0.26	0.07	-0.17	0.11	-0.19	-0.16	0.03
		(-0.58,0.05)	(-0.49,0.03)		(-0.48,0.08)			(-0.42,0.13)	
		(-0.79,0.26)	(-0.62,0.22)		(-0.75,0.55)			(-0.56,0.30)	
(6b)	Fed debt/GDP (+)	-0.58**	-0.62**	0.39	-0.37*	0.18	-0.42*	-0.28	0.08
		(-0.76,-0.40)	(-0.76,-0.40)		(-0.80,-0.13)			(-0.51,0.01)	
		(-0.87,-0.28)	(-0.83,-0.22)		(-0.85,0.01)			(-0.64,0.19)	
	World debt/GDP (+)	-0.25*	-0.45*	0.20	-0.29*	0.14	-0.32*	-0.22	0.05
		(-0.45,-0.05)	(-0.64,-0.17)		(-0.70,-0.01)			(-0.47,0.08)	
		(-0.58,0.08)	(-0.74,0.03)		(-0.80,0.11)			(-0.62,0.27)	
(7)	Current account/GDP (+)	0.18	0.12	0.01	0.06	0.09	0.03	0.07	0.00
		(-0.09,0.44)	(-0.17,0.38)		(-0.23,0.39)			(-0.22,0.33)	
		(-0.26,0.61)	(-0.35,0.53)		(-0.60,0.70)			(-0.39,0.49)	

A4. Expanded Table 4, continued

Long run correlations, 1950-2016

	(1) Correlate (expected sign)	(2) 10Y moving avg. $\hat{\rho}^{MA}$	(3a) Lowpass filter–I(0) $\hat{\rho}^{LP}$	(3b) R^2	(4a) Lowpass filter–I(d) mean $\hat{\rho}^{LP}$	(4b) R^2	(4c) median $\hat{\rho}^{LP}$	(5a) Lowpass filter–I(1) $\hat{\rho}^{LP}$	(5b) R^2
(8)	Relative price inv. goods (+)	0.22	0.20	0.04	0.10	0.07	0.10	0.10	0.01
		(-0.06,0.50)	(-0.09,0.44)		(-0.13,0.32)			(-0.19,0.36)	
		(-0.24,0.68)	(-0.27,0.58)		(-0.32,0.55)			(-0.36,0.51)	
(9)	Top 10% income share (-)	-0.25	-0.29*	0.08	-0.18	0.08	-0.23	-0.18	0.03
		(-0.50,0.00)	(-0.51,-0.01)		(-0.40,0.01)			(-0.43,-0.10)	
		(-0.66,0.16)	(-0.64,0.18)		(-0.60,0.27)			(-0.57,0.29)	
(10)	Baa-10 yr Treasury spread (-)	-0.04	-0.07	0.00	-0.09	0.09	-0.07	-0.16	0.03
		(-0.37,0.29)	(-0.33,0.22)		(-0.43,0.35)			(-0.41,0.13)	
		(-0.58,0.50)	(-0.49,0.39)		(-0.70,0.60)			(-0.56,0.31)	
(11a)	π_GDP (-)	0.33**	0.26	0.07	0.06	0.09	0.03	-0.10	0.01
		(0.15,0.51)	(-0.02,0.50)		(-0.25,0.60)			(-0.37,0.18)	
		(0.03,0.63)	(-0.22,0.63)		(-0.50,0.75)			(-0.52,0.36)	
(11b)	π_NDS (-)	0.39**	0.31*	0.09	0.08	0.09	0.05	-0.16	0.03
		(0.21,0.56)	(0.02,0.53)		(-0.21,0.60)			(-0.41,0.13)	
		(0.10,0.67)	(-0.17,0.65)		(-0.45,0.75)			(-0.56,0.31)	
(12a)	M1 growth (-)	0.22	0.00	0.00	-0.04	0.08	-0.03	-0.03	0.00
		(-0.08,0.51)	(-0.28,0.27)		(-0.36,0.27)			(-0.30,0.25)	
		(-0.27,0.71)	(-0.44,0.44)		(-0.70,0.60)			(-0.46,0.42)	
(12b)	M2 growth (-)	0.11	0.15	0.02	0.08	0.09	0.05	-0.02	0.00
		(-0.12,0.34)	(-0.14,0.40)		(-0.21,0.38)			(-0.30,0.26)	
		(-0.27,0.49)	(-0.32,0.55)		(-0.55,0.75)			(-0.45,0.42)	

A5 Low frequency estimation of the intertermporal IS

The intertemporal IS equation (2.4) provides a simple framework to investigate how a combined set of variables relates to the safe rate. Imposing values of ψ and γ, we run a band spectral regression of r_t the right hand side of (2.4) and on the right hand side of (2.5).

Specifically, for given values of ψ, γ and $\theta \equiv (1-\gamma) / (1-\psi^{-1})$ let

$$(A5.1)\quad z_t \equiv (1/\psi)E_t\Delta c_{t+1} - \frac{1}{2}\left[(\theta/\psi^2)\mathrm{var}_t\Delta c_{t+1} + \mathrm{var}_t\pi_{t+1} + 2(\theta/\psi)\mathrm{cov}_t(\Delta c_{t+1},\pi_{t+1})\right] + \frac{1}{2}(\theta-1)\left[\mathrm{var}_t r_{mt+1} + 2\,\mathrm{cov}_t(r_{mt+1},\pi_{t+1})\right].$$

In constructing z_t, we use the measures of conditional second moments described in the text, rescaled so that the units are commensurate with the units for $E_t\Delta c_{t+1}$. We then execute a band spectral regression of low pass r_t on low pass z_t, yielding a regression slope of $\hat{\beta}$:

$$(A5.2)\quad r_t^{LP} = \hat{\beta} z_t^{LP} + \text{residual}.$$

There is no constant term in (A5.2) because Müller and Watson's filter sweeps out sample means. If our imposed parameter values are reasonable, then, under equation (2.4), the regression (A5.2) should deliver $\beta \approx 1$ and $\bar{R}^2$ near 1.

We execute the regression both under the assumption of I(0) data, and using Müller and Watson's (2018) (*A*, *B*, *c*, *d*) model. For the latter, we report posterior means, labeled I(*d*) in Table A5 below. The frequency cutoff is again 10 years. For confidence intervals, we followed Müller and Watson's (2015, "Low Frequency Econometrics," NBER Working Paper 21564) recommendation to use a *t* distribution with degrees of freedom that are dependent on sample size and number of regressors. For our application, that means 20 degrees of freedom for the 1910-2016 sample and 12 degrees of freedom for the 1951-2016 sample.

The parameter values we used are listed in column (1) of Table A5 below. Consistent with Tables 3 and 4, the regression performs better for the 1951-2016 sample (columns (4) and (5)) than for the 1910-2016 sample (columns (2) and (3)): adjusted R^2's are higher, and $\hat{\beta}$ is closer to 1. However, with the exception of row (1) in the 1951-2016 sample, none of the confidence intervals include 1, and in that sense one can reject the null hypothesis that $\beta=1$.

In both panels the R^2 is notably higher for the Epstein-Zin-Weil specification (2.4) than for the constant elasticity specification (2.5). This is consistent with the literature cited in the text that finds that the additional structure provided by Epstein-Zin-Weil substantially improves our understanding of the safe real rate. However, the fact that the coefficient estimate is far from 1 indicates that the model still is hardly the final word on trends in the safe real rate.

Table A5

Band Spectral Regression of Low Pass r_t on Low Pass z_t

		1910-2016				1951-2016			
	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
		I(0)		I(*d*)		I(0)		I(d)	
		$\hat{\beta}$	R^2	$\hat{\beta}$	R^2	$\hat{\beta}$	R^2	$\hat{\beta}$	R^2
(1)	$\gamma = \psi^{-1} = 1 \equiv \sigma$	-0.01	0.00	0.04	0.04	1.02	0.23	0.94	0.18
		(-0.34,0.33)		(-0.34,0.39)		(0.45,1.59)		(0.28,1.57)	
(2)	$\gamma = \psi^{-1} = 2 \equiv \sigma$	0.00	0.00	0.03	0.04	0.51	0.23	0.47	0.18
		(-0.16,0.17)		(-0.16,0.20)		(0.23,0.80)		(0.14,0.78)	
(3)	$\gamma = 10$, $\psi = 1.5$	0.07	0.28	0.07	0.18	0.13	0.41	0.12	0.31
		(0.04,0.09)		(0.03,0.10)		(0.08,0.17)		(0.07,0.18)	
(4)	$\gamma = 3$, $\psi = 1.5$	0.25	0.26	0.25	0.18	0.47	0.43	0.45	0.33
		(0.15,0.35)		(0.12,0.39)		(0.31,0.63)		(0.26,0.64)	

Notes to Table A5: See discussion on previous page.

Table A6

Summary Statistics on the Correlates, 1890-2016

	Correlate	(1) Mean	(2) St. Dev.	(3) Median	(4) 1st Order Autocorr	(5) Max	(6) Min
(1a)	GDP growth	1.97	4.38	2.16	0.40	16.21	-14.43
(1b)	Consumption growth	1.98	3.05	2.11	0.06	10.69	-10.02
(1c)	World GDP growth	1.77	3.15	2.15	0.38	7.95	-13.76
(1d)	TFP growth	1.15	3.04	1.03	0.08	9.45	-7.92
	Labor productivity growth	2.10	2.50	2.11	-0.10	10.16	-6.18
(2a)	var_t(GDP growth)	14.27	14.42	6.35	0.99	52.17	0.99
	var_t(C growth)	7.59	6.71	6.60	0.98	22.85	0.57
(2b)	var_t(π_GDP)	12.70	16.66	6.88	0.98	58.95	0.13
	var_t(π_PCE)	10.64	14.15	2.39	0.98	46.01	0.23
(2c)	var_t(mkt return)	305.99	152.63	257.50	0.98	670.14	101.29
	var_t(mkt return) (PCE defl.)	326.32	139.72	290.02	0.97	636.22	96.26
(3a)	cov_t(π_GDP,GDP growth)	3.21	6.02	0.49	0.96	20.29	-6.09
	cov_t(π_PCE,C growth)	1.18	3.27	-0.01	0.95	11.85	-3.63
(3b)	cov_t(π_GDP,mkt return)	-18.84	26.08	-10.62	0.97	8.52	-94.58
	cov_t(π_PCE,mkt return)	-17.98	19.08	-15.41	0.96	8.50	-69.84
(4a)	Labor hours growth	1.14	3.95	1.74	0.30	12.23	-13.19
(4b)	Growth in capital per hour	2.24	3.92	1.93	0.32	15.42	-10.58
	Per capita capital growth	2.08	1.35	1.81	0.83	5.73	-1.07

Table A6, continued

Summary Statistics on the Correlates, 1890-2016

	Correlate	(1) Mean	(2) St. Dev.	(3) Median	(4) 1st Order Autocorr	(5) Max	(6) Min
(5a)	Dependency ratio	44.20	3.06	44.32	1.00	49.98	39.85
(5b)	Percent aged 40-64	25.29	3.91	25.85	1.00	33.33	18.21
	MY ratio	0.77	0.18	0.75	0.99	1.13	0.52
	ΔDependency ratio	-0.07	0.28	-0.14	0.86	0.65	-0.52
(5c)	ΔPercent aged 40-64	0.11	0.19	0.11	0.90	0.57	-0.26
	ΔMY ratio	0.00	0.02	0.00	0.86	0.06	-0.05
	ΔLife expectancy	0.27	2.18	0.20	-0.40	15.60	-11.80
	Fed total deficit/GDP	2.28	4.40	1.00	0.75	26.86	-4.29
(6a)	Fed primary deficit/GDP	1.06	4.39	-0.01	0.74	26.11	-5.87
(6b)	Fed debt/GDP	42.50	28.83	39.50	0.98	118.96	2.43
	World debt/GDP	58.17	26.38	58.45	0.96	172.81	26.31
(7)	Current account/GDP	-0.29	1.98	0.13	0.91	5.83	-5.79
(8)	Relative price inv. goods	1.25	0.13	1.28	0.97	1.57	0.96
(9)	Top 10% income share	0.39	0.06	0.38	0.96	0.50	0.31
(10)	Baa-10 yr Treasury spread	2.03	0.93	1.98	0.84	5.52	0.59
(11a)	π_GDP	2.44	4.39	2.25	0.51	21.01	-15.99
(11b)	π_PCE	2.39	4.32	1.99	0.65	16.42	-12.56
(12a)	M1 growth	5.51	6.09	4.87	0.70	26.61	-13.41
(12b)	M2 growth	6.44	5.16	6.52	0.58	23.39	-16.91

Table A7

Summary Statistics on the Correlates, 1950-2016

	Correlate	(1) Mean	(2) St. Dev.	(3) Median	(4) 1st Order Autocorr	(5) Max	(6) Min
(1a)	GDP growth	2.00	2.20	2.11	0.19	6.31	-3.69
(1b)	Consumption growth	1.95	1.22	2.02	0.48	4.00	-2.00
(1c)	World GDP growth	2.27	1.71	2.35	0.39	5.67	-4.25
(1d)	TFP growth	1.12	1.77	0.88	0.05	6.06	-3.74
	Labor productivity growth	2.09	1.49	2.05	0.11	6.40	-1.67
(2a)	var_t(C growth)	1.40	1.28	0.97	0.96	8.59	0.43
	var_t(GDP growth)	10.01	12.20	4.44	0.99	44.73	0.99
(2b)	var_t(π_NDS)	2.22	2.50	1.48	0.98	12.80	0.29
	var_t(π_GDP)	3.08	4.09	1.21	0.99	17.71	0.13
(2c)	var_t(mkt return)	246.04	75.86	250.85	0.90	393.55	96.57
	var_t(mkt return) (GDP defl.)	246.80	81.75	252.57	0.91	529.54	101.29
(3a)	cov_t(π_NDS,C growth)	0.03	0.75	0.05	0.75	4.70	-0.71
	cov_t(π_GDP,GDP growth)	-0.32	1.95	-0.04	0.79	7.69	-6.09
(3b)	cov_t(π_NDS,mkt return)	-11.08	7.54	-11.91	0.94	0.62	-24.64
	cov_t(π_GDP,mkt return)	-10.42	9.69	-10.97	0.95	1.77	-32.69
(4a)	Labor hours growth	1.05	2.39	1.51	0.23	5.68	-7.35
(4b)	Capital deepening	2.52	2.30	2.13	0.25	7.92	-1.73
	Per capita capital growth	2.42	1.32	2.28	0.80	5.15	-0.79

Table A7, continued

Summary Statistics on the Correlates, 1950-2016

	Correlate	(1) Mean	(2) St. Dev.	(3) Median	(4) 1st Order Autocorr	(5) Max	(6) Min
(5a)	Dependency ratio	43.31	2.98	41.93	0.99	48.83	39.85
(5b)	Dependency ratio, world	42.50	2.61	42.59	1.00	46.13	38.98
(5c)	Percent aged 40-64	27.75	2.86	26.55	1.00	33.33	24.53
(5d)	Percent aged 40-64, world	28.34	2.60	26.98	1.00	33.58	25.93
	MY ratio	0.87	0.18	0.91	0.99	1.13	0.55
	MY ratio, world	0.87	0.13	0.82	1.00	1.09	0.70
	ΔDependency ratio	-0.02	0.33	-0.03	0.95	0.65	-0.52
	ΔDependency ratio, world	-0.07	0.17	-0.10	0.97	0.24	-0.44
(5e)	ΔPercent aged 40-64	0.08	0.24	-0.01	0.94	0.57	-0.26
(5f)	ΔPercent aged 40-64, world	0.11	0.15	0.08	0.96	0.36	-0.20
	ΔLife expectancy	0.18	0.23	0.15	-0.06	0.80	-0.61
	ΔMY ratio	0.00	0.03	0.00	0.94	0.05	-0.05
	ΔMY ratio, world	0.00	0.01	0.00	0.97	0.03	-0.02

Table A7, continued

Summary Statistics on the Correlates, 1950-2016

	Correlate	(1) Mean	(2) St. Dev.	(3) Median	(4) 1st Order Autocorr	(5) Max	(6) Min
	Fed total deficit/GDP	2.20	2.33	2.14	0.79	9.80	-2.30
(6a)	Fed primary deficit/GDP	0.43	2.30	0.16	0.77	8.50	-4.46
(6b)	Fed debt/GDP	56.30	19.60	55.02	0.98	105.25	30.98
	World debt/GDP	51.50	17.81	49.82	0.99	96.91	26.31
(7)	Current account/GDP	-1.27	1.85	-0.60	0.95	1.17	-5.79
(8)	Relative price inv. goods	1.22	0.16	1.31	0.99	1.43	0.96
(9)	Top 10% income share	0.37	0.06	0.35	0.98	0.50	0.31
(10)	Baa-10 yr Treasury spread	1.85	0.80	1.81	0.81	4.04	0.59
(11a)	π_GDP	3.14	2.13	2.30	0.81	8.98	0.79
(11b)	π_NDS	3.33	2.20	2.81	0.79	10.34	0.13
(12a)	M1 growth	5.08	3.83	4.83	0.69	14.29	-3.34
(12b)	M2 growth	6.43	2.38	6.52	0.63	12.00	1.02

Some Evidence on Secular Drivers of U.S. Safe Real Rates

Kurt G. Lunsford
Federal Reserve Bank of Cleveland

Kenneth D. West
University of Wisconsin

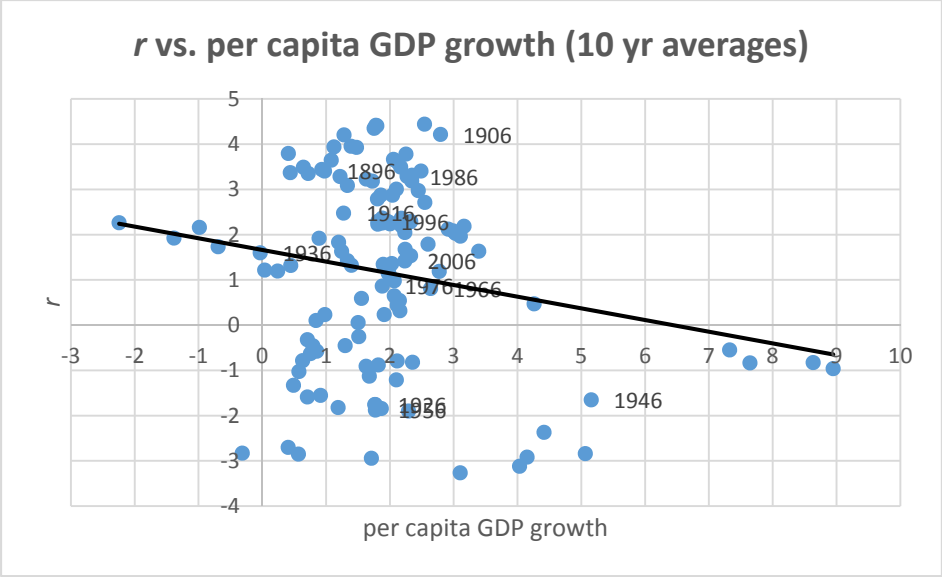
October 2017
Revised August 2018

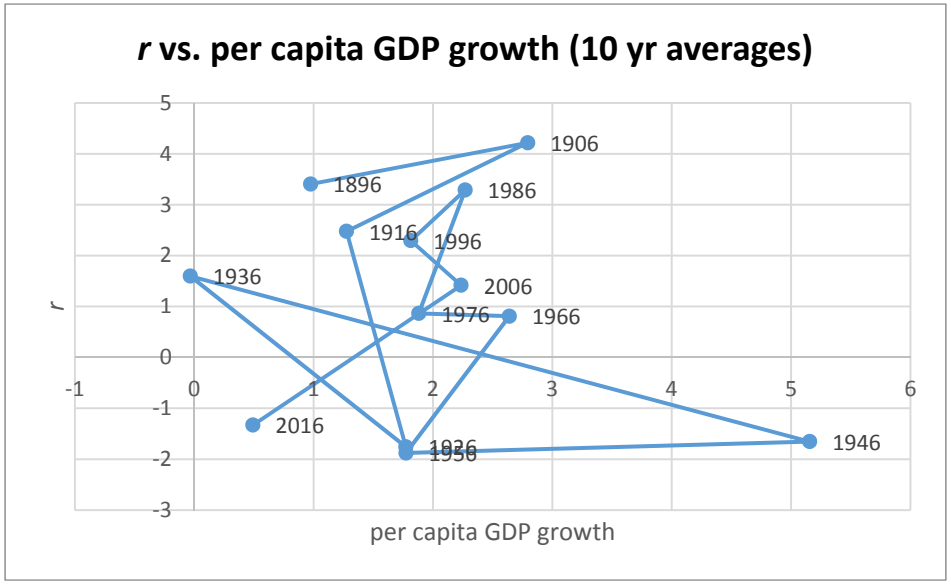
APPENDIX 2

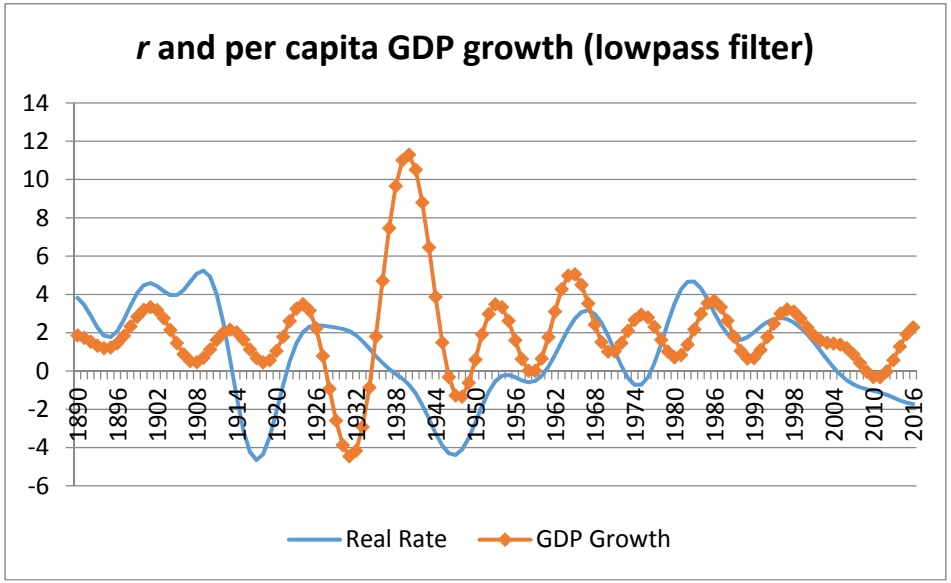
This appendix presents the following graphs, for each correlate:

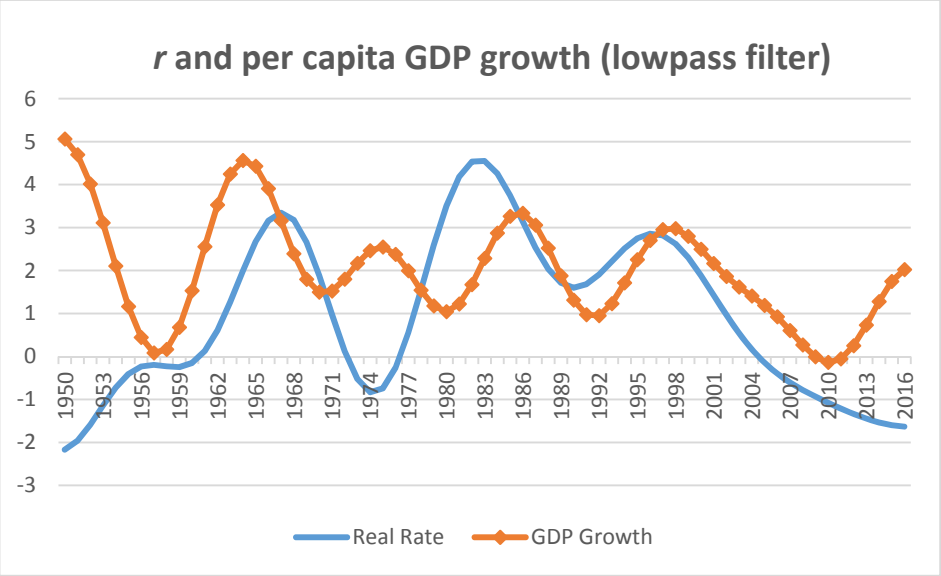
- Scatterplot of 10 year averages, correlate vs. *r*
- Every 10th observation of the preceding scatterplot (to make it easier to see movement over time)
- Low frequency component of a correlate and *r*, computed per Müller and Watson (2018), 1890-2016
- Low frequency component of a correlate and *r*, computed per Müller and Watson (2018), 1950-2016

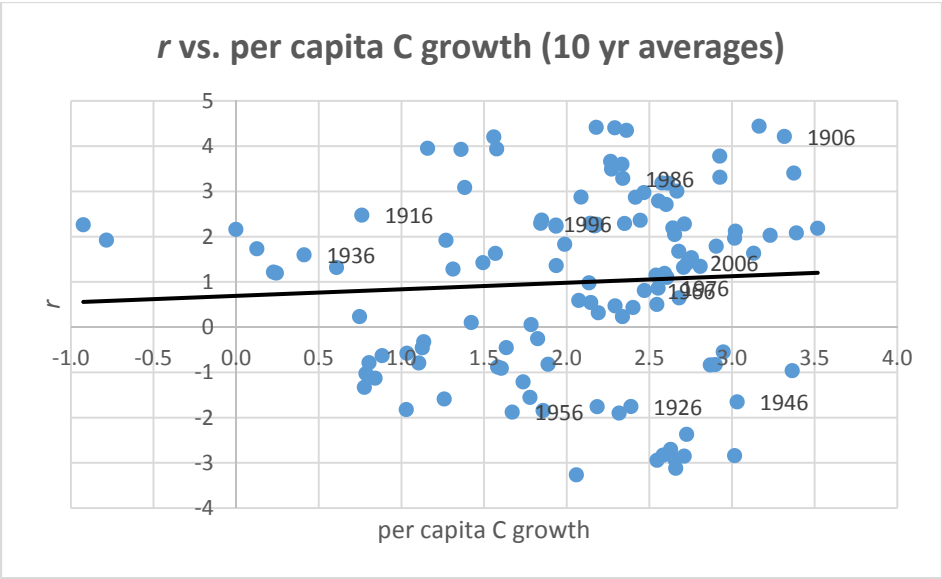
If data on a correlate is not available over the entire indicated period, the sample period is adjusted accordingly. If a correlate is used in only one sample period but not the other, it appears in only one of the two low frequency plots. The values of *r*, and of Müller and Watson's (2018) the low frequency component of *r*, are the same across graphs.

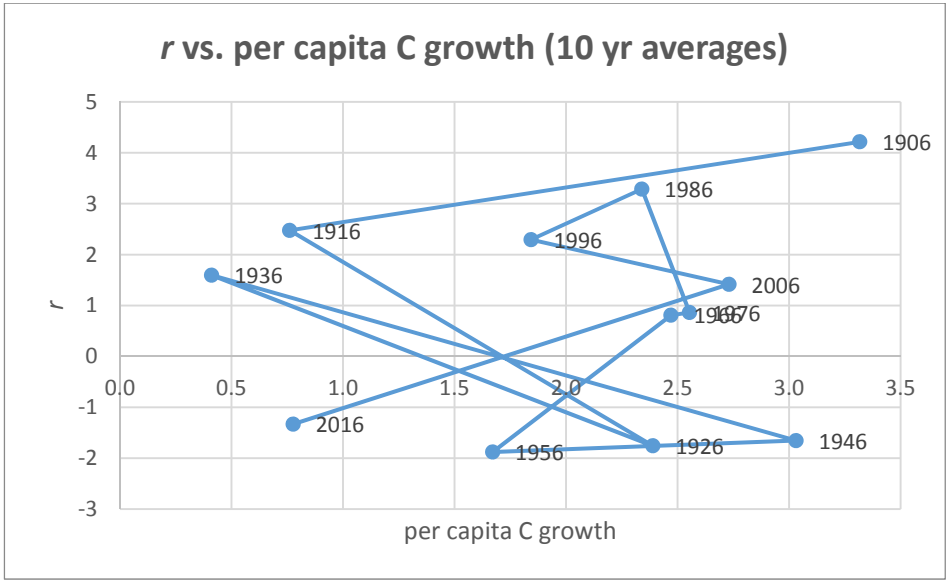

r vs. per capita GDP growth (10 yr averages)
r
per capita GDP growth
1906
1896
1986
1916
1996
1936
2006
1976
1966
1946
1926
1956

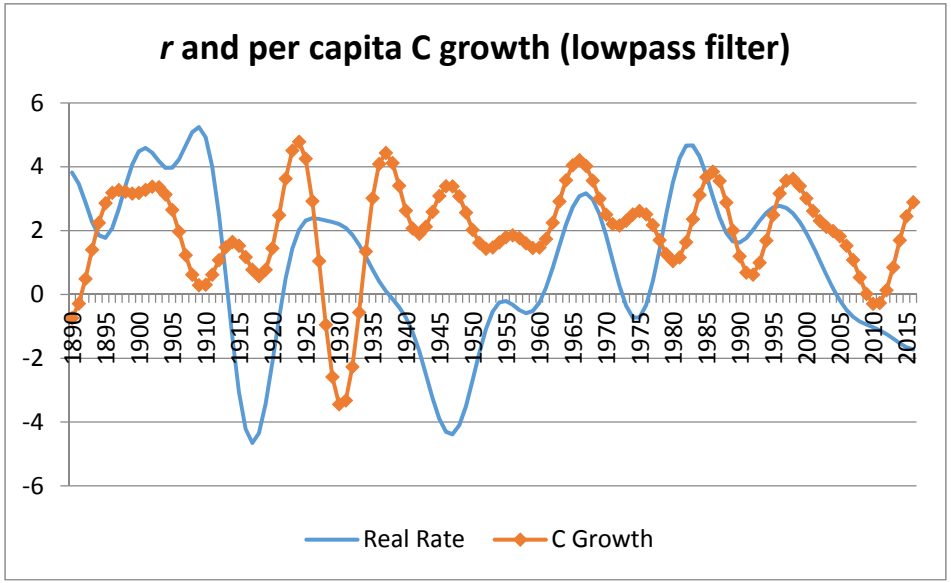

r vs. per capita GDP growth (10 yr averages)
r
per capita GDP growth
1906
1896
1986
1916
1996
1936
2006
1976
1966
2016
1946
1926
1956

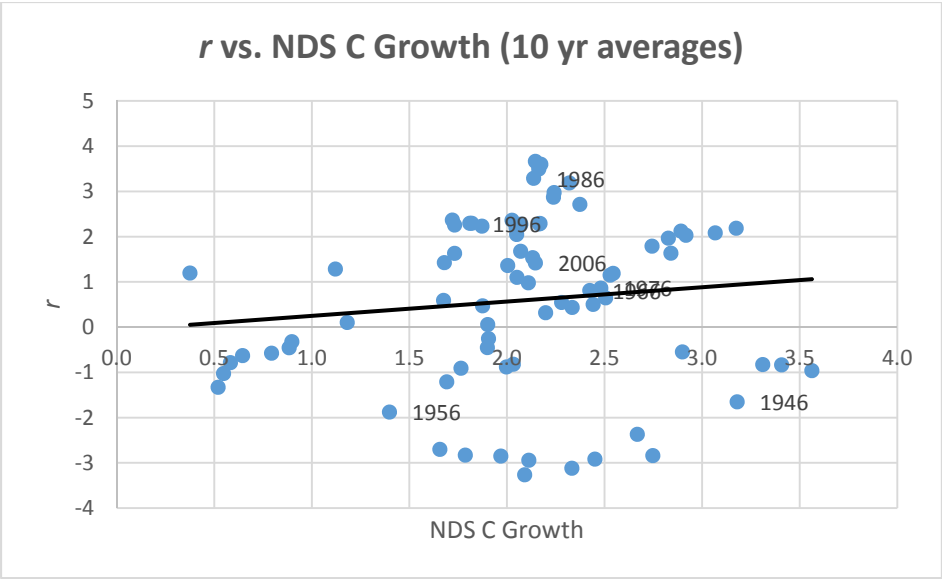

r and per capita GDP growth (lowpass filter)
Real Rate
GDP Growth

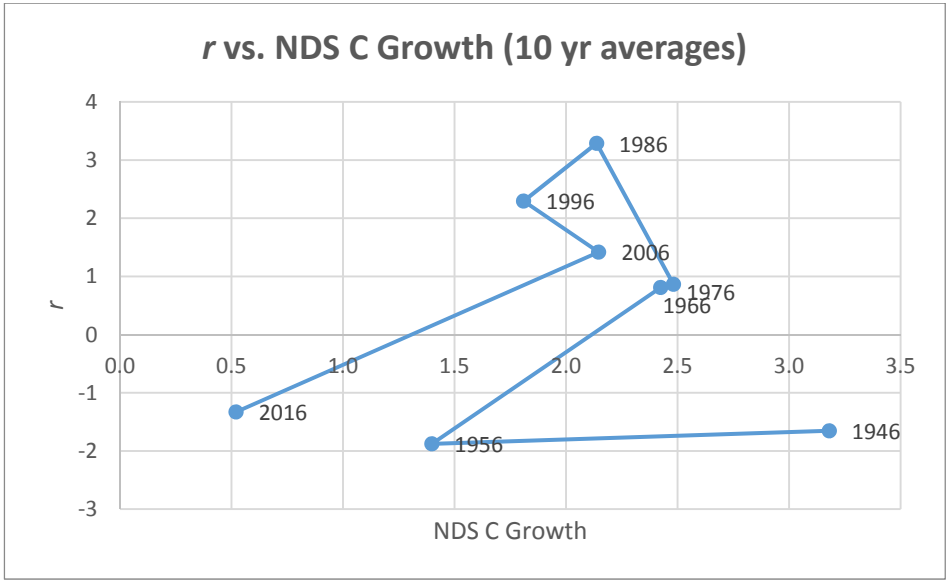

r and per capita GDP growth (lowpass filter)
Real Rate
GDP Growth

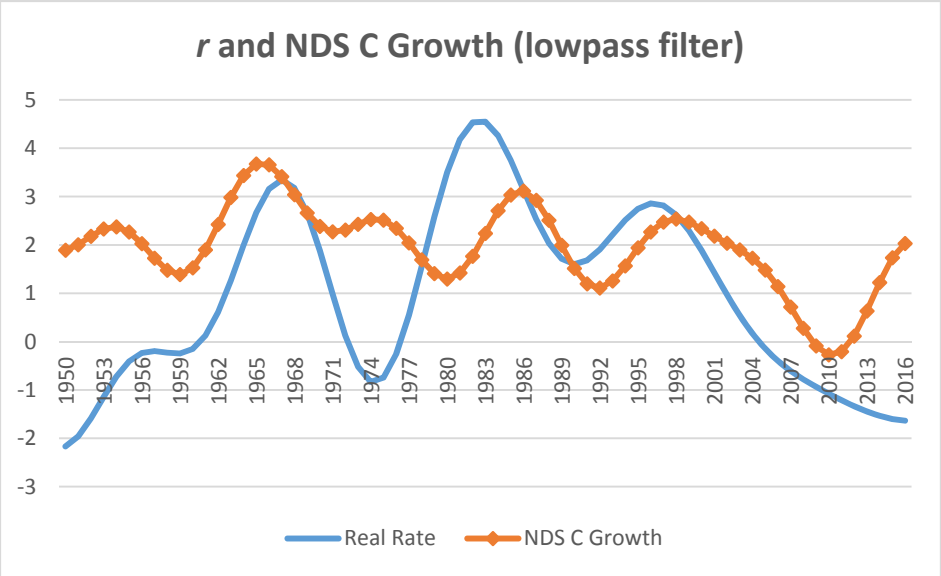

r vs. per capita C growth (10 yr averages)
r
per capita C growth
1906
1986
1916
1996
1936
2006
1976
1956
1926
1946

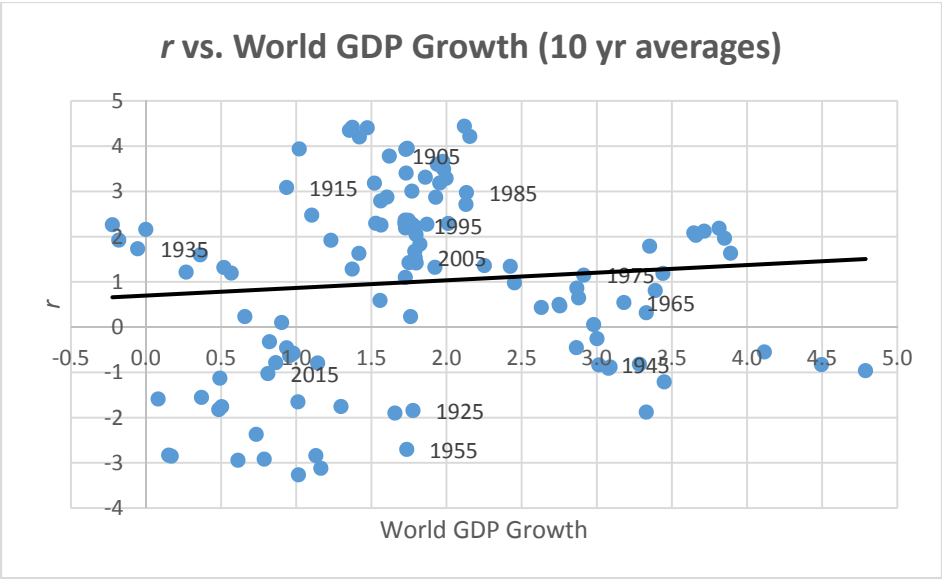

r vs. per capita C growth (10 yr averages)
r
per capita C growth
1906
1986
1916
1996
1936
2006
1976
2016
1956
1926
1946

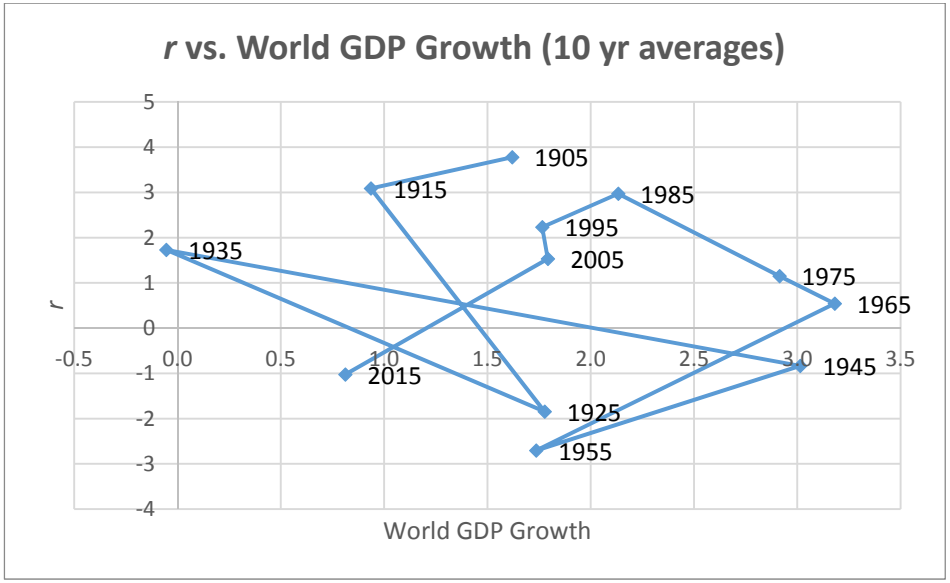

r and per capita C growth (lowpass filter)
Real Rate
C Growth

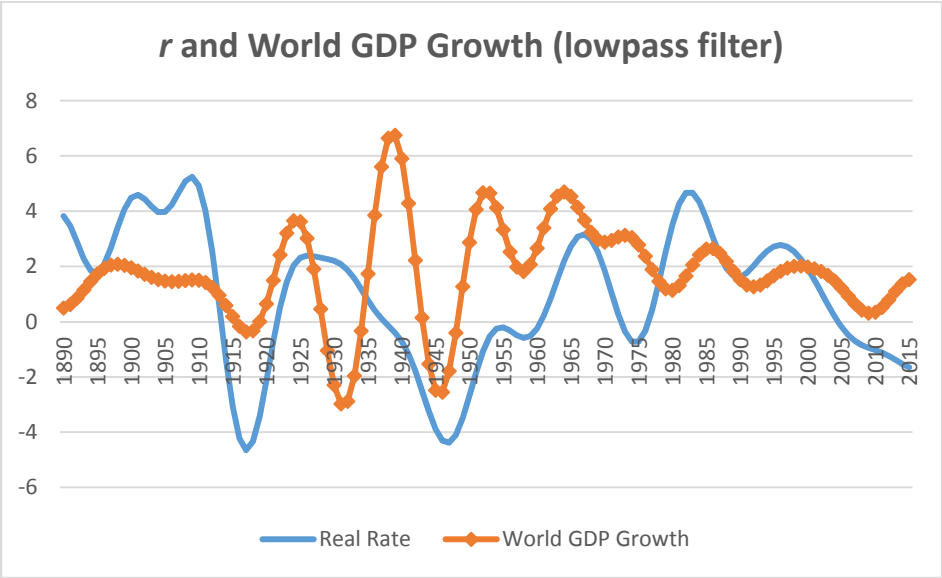

r vs. NDS C Growth (10 yr averages)
r
NDS C Growth
1986
1996
2006
1956
1946

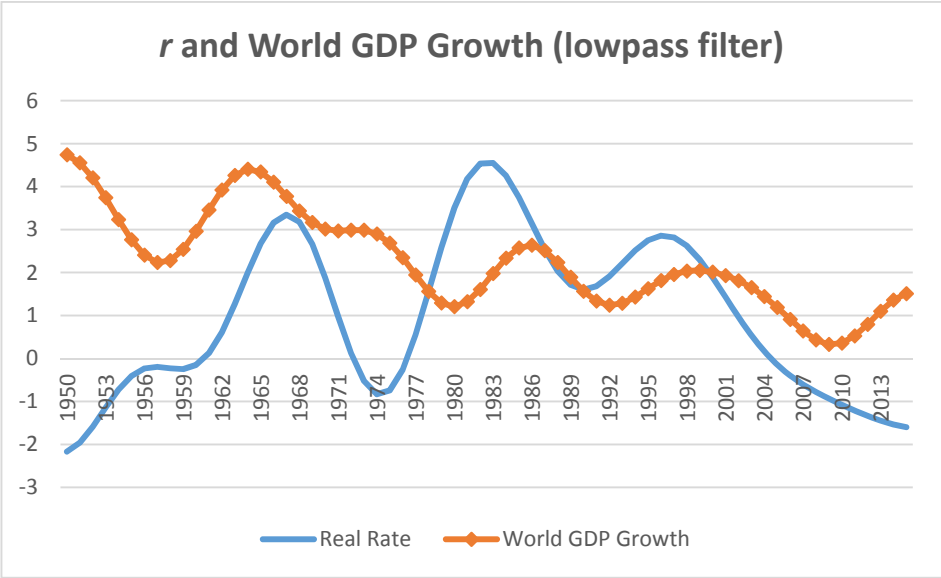

r vs. NDS C Growth (10 yr averages)
r
NDS C Growth
1986
1996
2006
1976
1966
2016
1956
1946

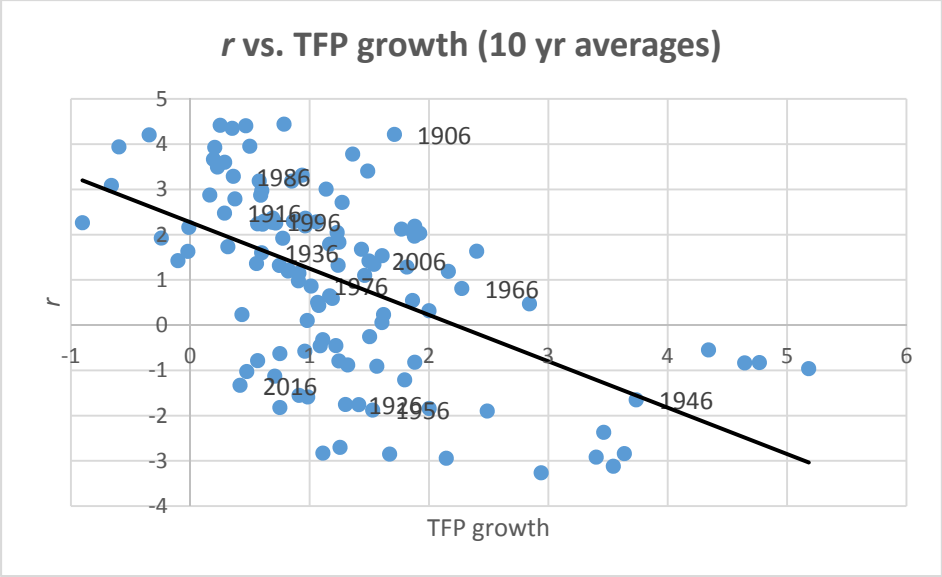

r and NDS C Growth (lowpass filter)
Real Rate
NDS C Growth

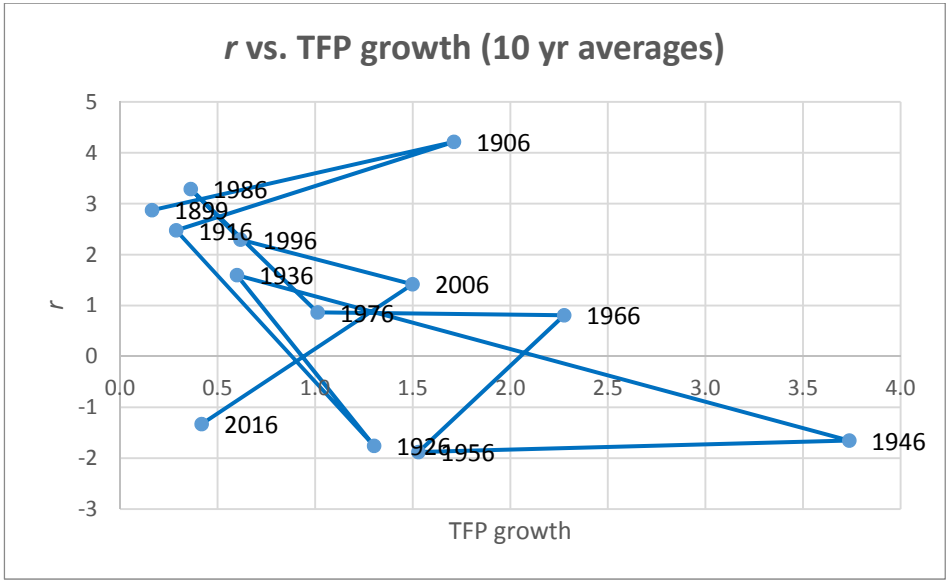

r vs. World GDP Growth (10 yr averages)
r
World GDP Growth
1905
1915
1985
1995
2005
1935
1975
1965
1945
2015
1925
1955

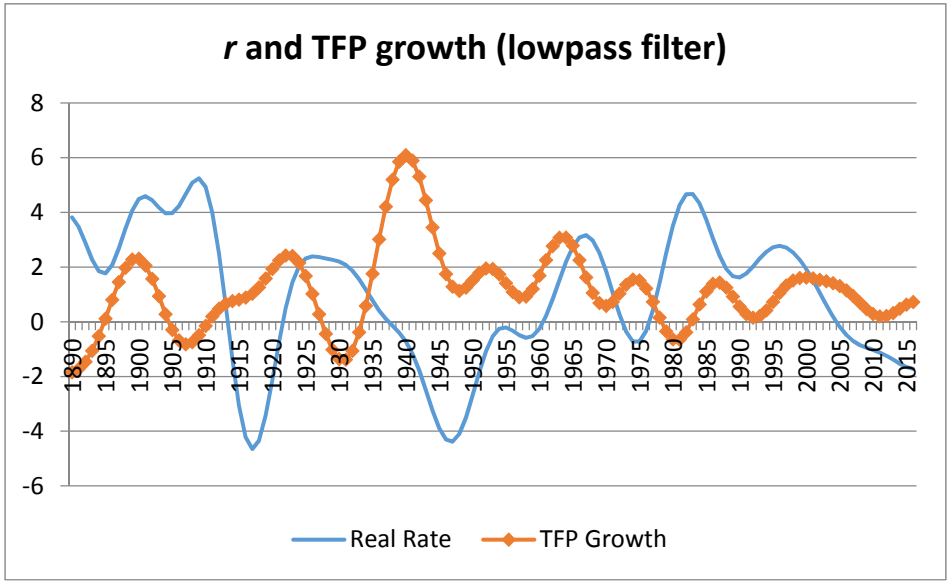

r vs. World GDP Growth (10 yr averages)
r
World GDP Growth
1905
1915
1985
1995
2005
1935
1975
1965
1945
2015
1925
1955

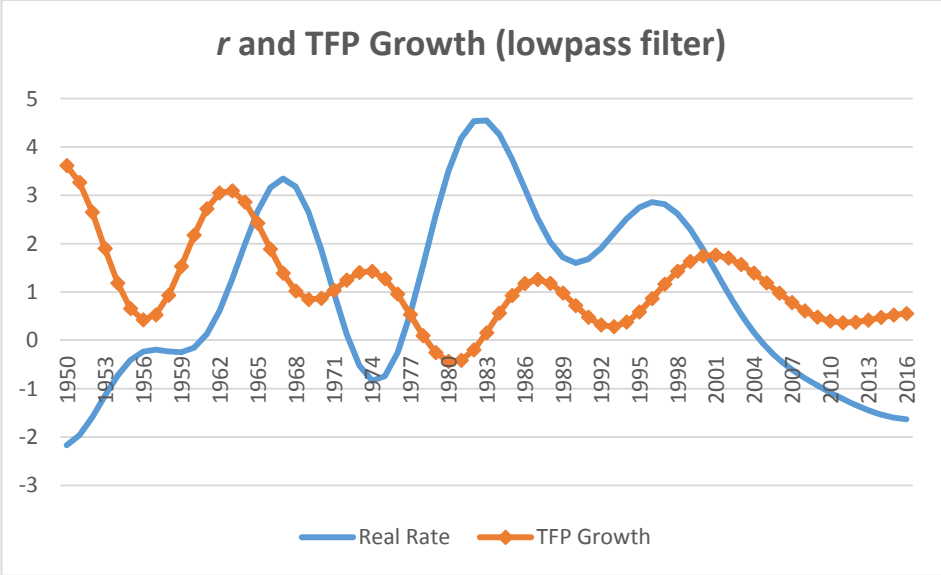

r and World GDP Growth (lowpass filter)
Real Rate
World GDP Growth

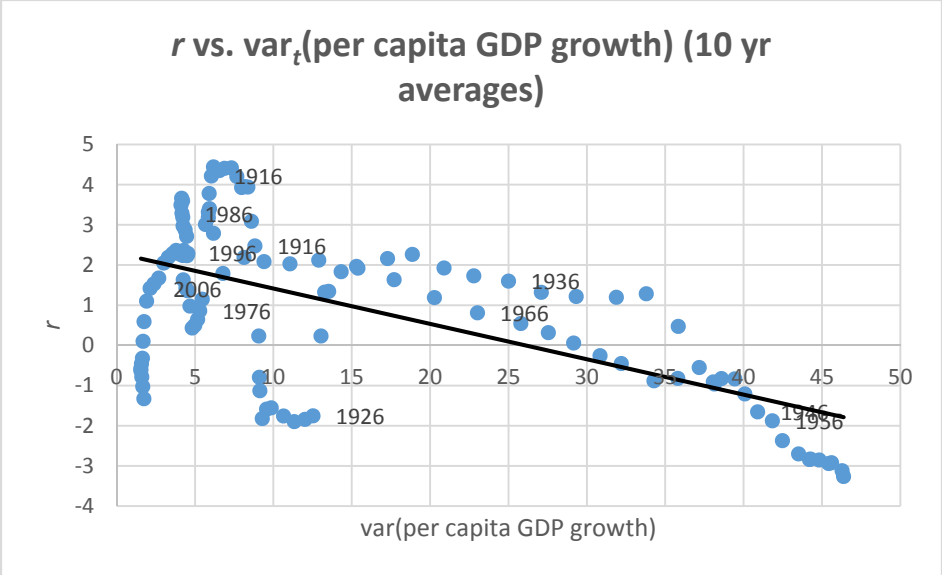

r and World GDP Growth (lowpass filter)
Real Rate
World GDP Growth

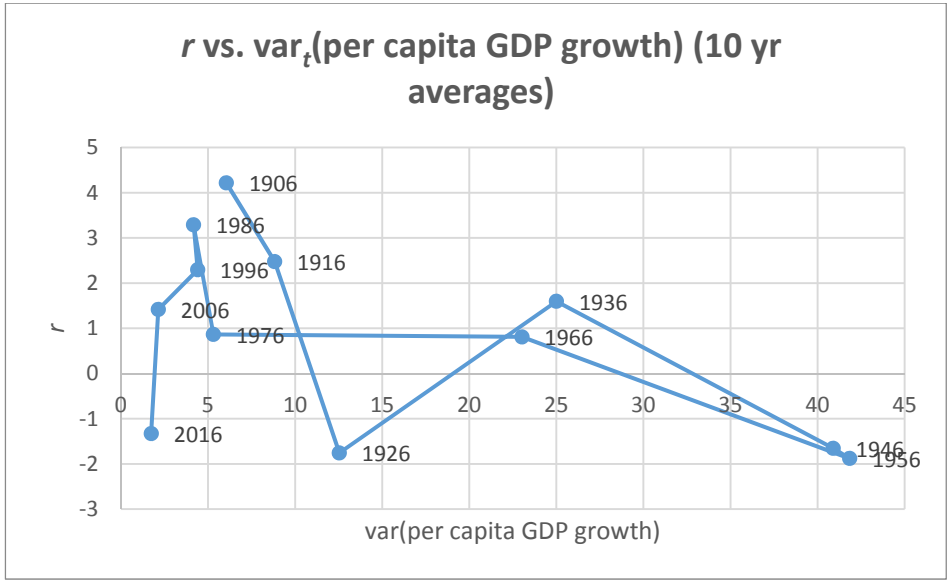

r vs. TFP growth (10 yr averages)
r
TFP growth
1906
1986
1916
1996
1936
2006
1976
1966
2016
1926
1956
1946

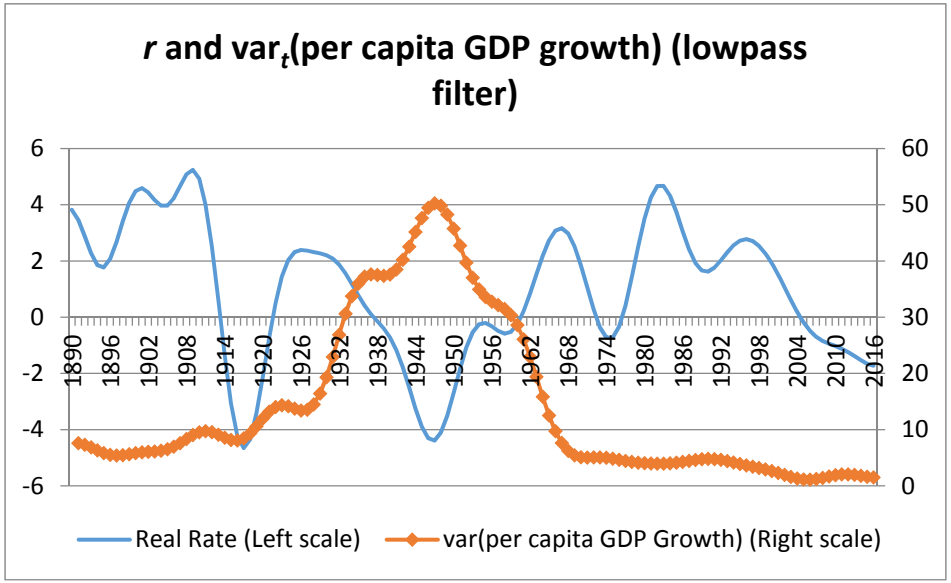

r vs. TFP growth (10 yr averages)
r
TFP growth
1906
1986
1899
1916
1996
1936
2006
1976
1966
2016
1926
1956
1946

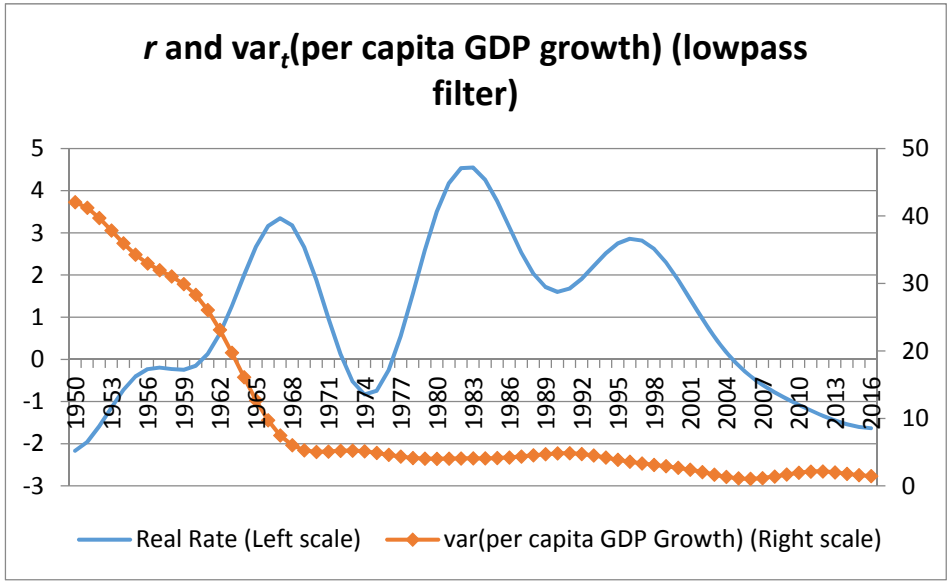

r and TFP growth (lowpass filter)
Real Rate
TFP Growth

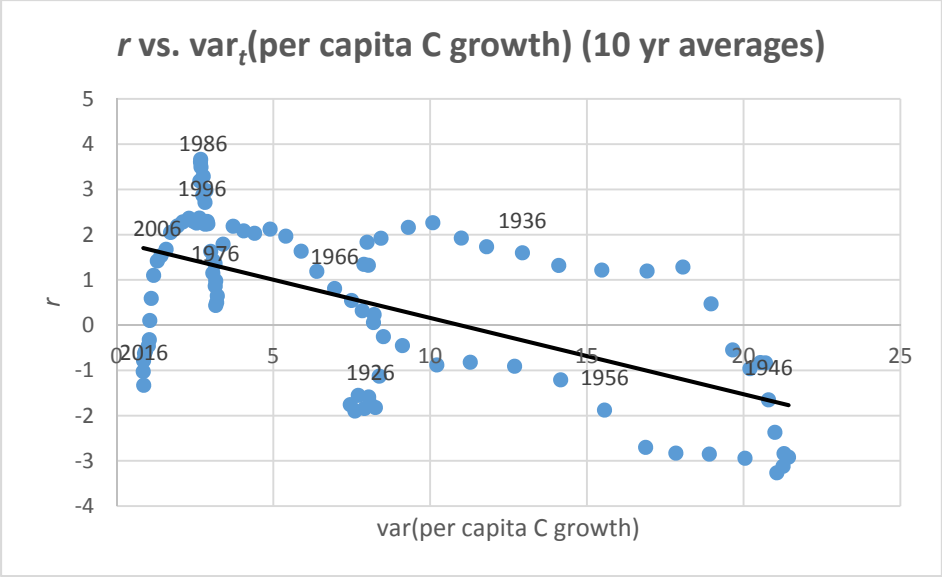

r and TFP Growth (lowpass filter)
Real Rate
TFP Growth

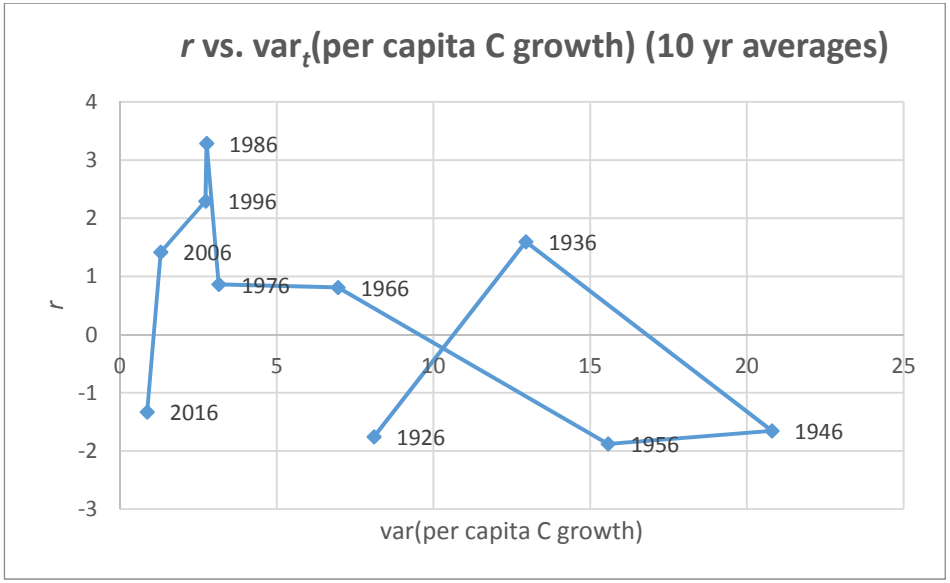

r vs. var$_t$(per capita GDP growth) (10 yr averages)
r
var(per capita GDP growth)
1916
1986
1996
1916
2006
1976
1936
1966
1926
1946
1956

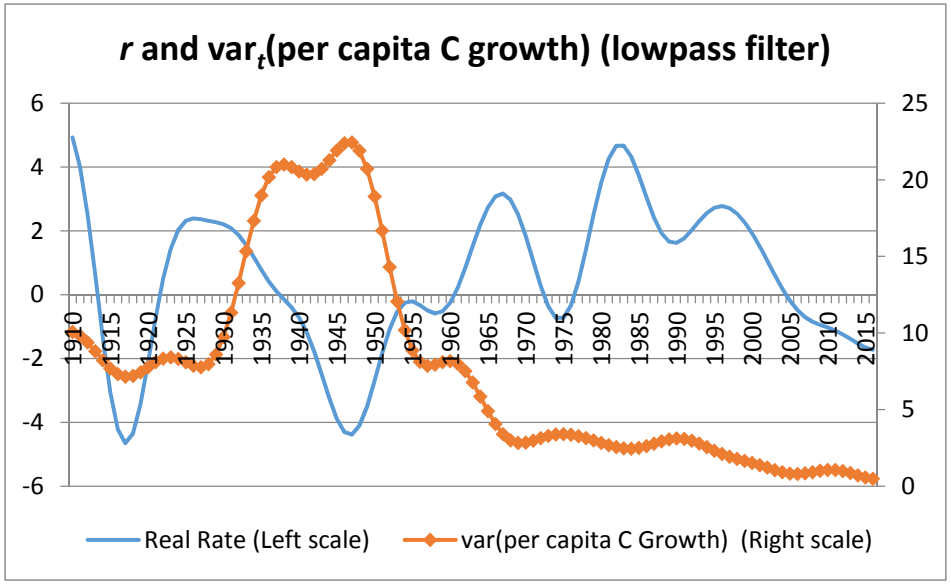

r vs. var$_t$(per capita GDP growth) (10 yr averages)
r
var(per capita GDP growth)
1906
1986
1996
1916
2006
1976
1936
1966
2016
1926
1946
1956

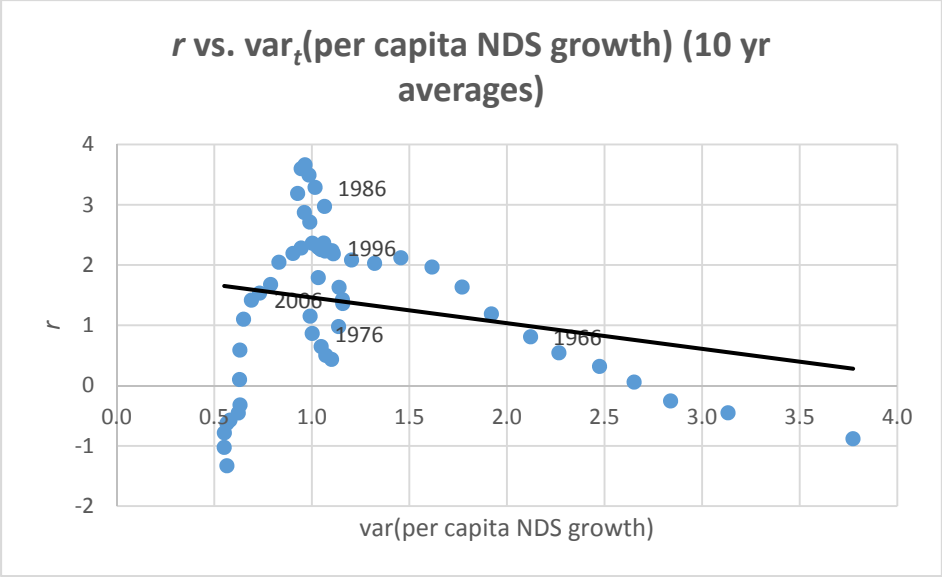

r and var$_t$(per capita GDP growth) (lowpass filter)
Real Rate (Left scale)
var(per capita GDP Growth) (Right scale)

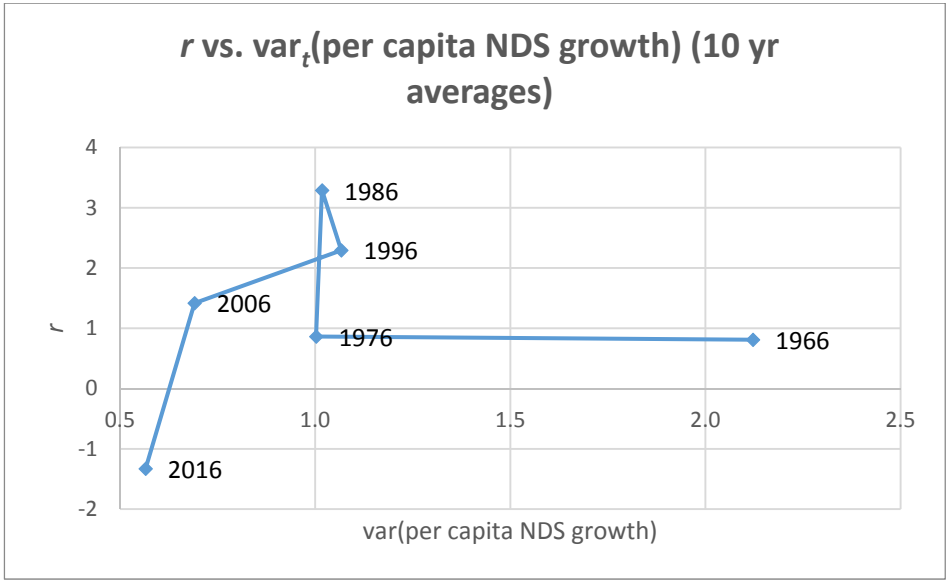

r and var$_t$(per capita GDP growth) (lowpass filter)
Real Rate (Left scale)
var(per capita GDP Growth) (Right scale)

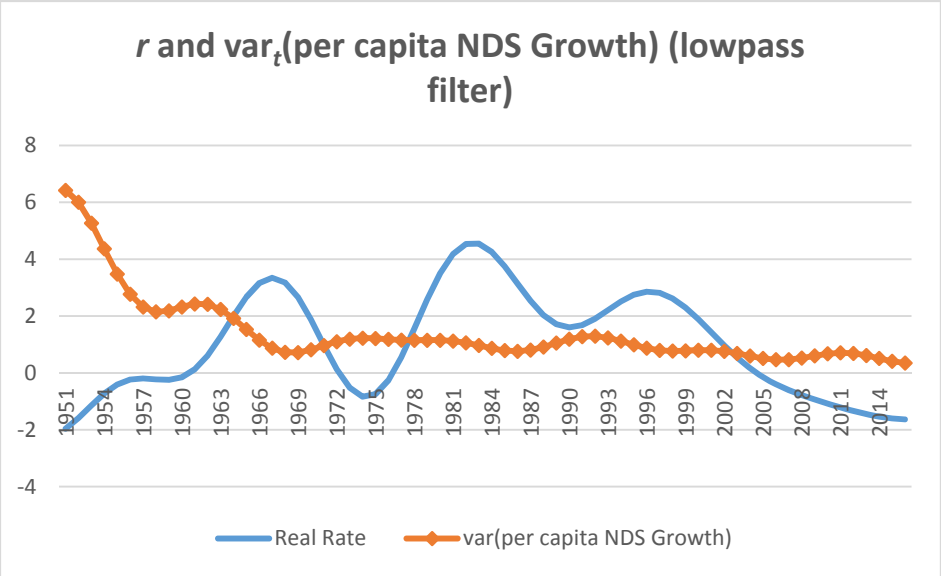

r vs. var$_t$(per capita C growth) (10 yr averages)
r
var(per capita C growth)
1986
1996
2006
1976
1966
1936
2016
1926
1956
1946

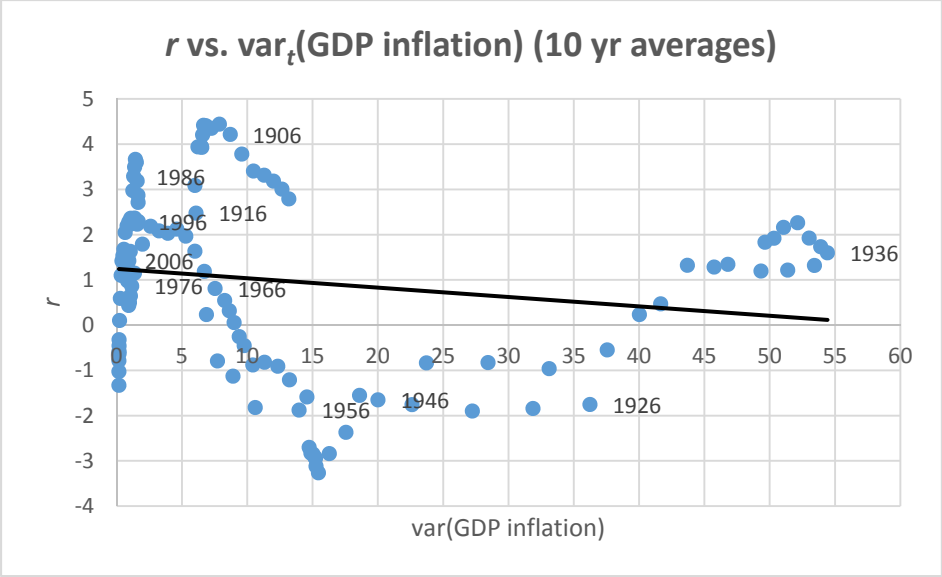

r vs. var$_t$(per capita C growth) (10 yr averages)
r
var(per capita C growth)
1986
1996
2006
1976
1966
1936
2016
1926
1956
1946

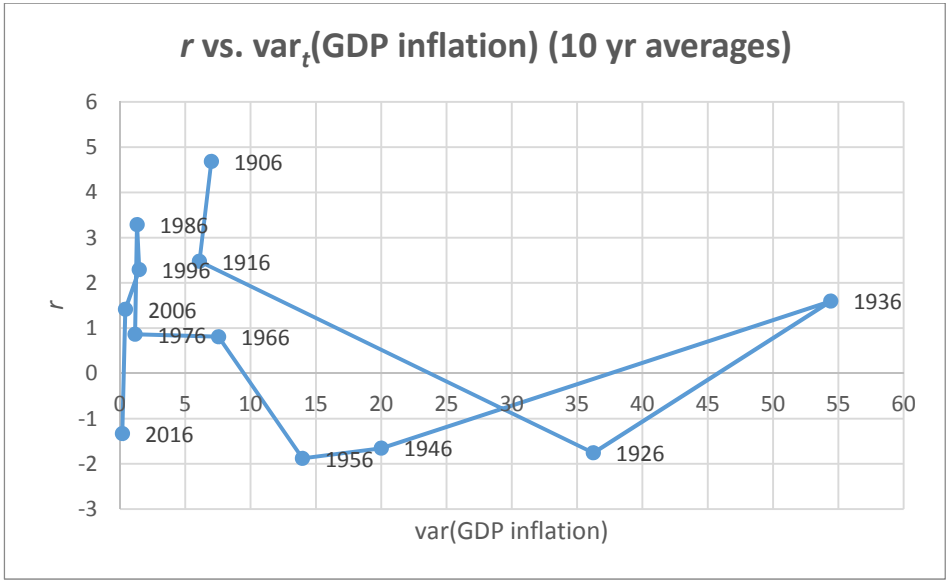

r and var$_t$(per capita C growth) (lowpass filter)
Real Rate (Left scale)
var(per capita C Growth) (Right scale)

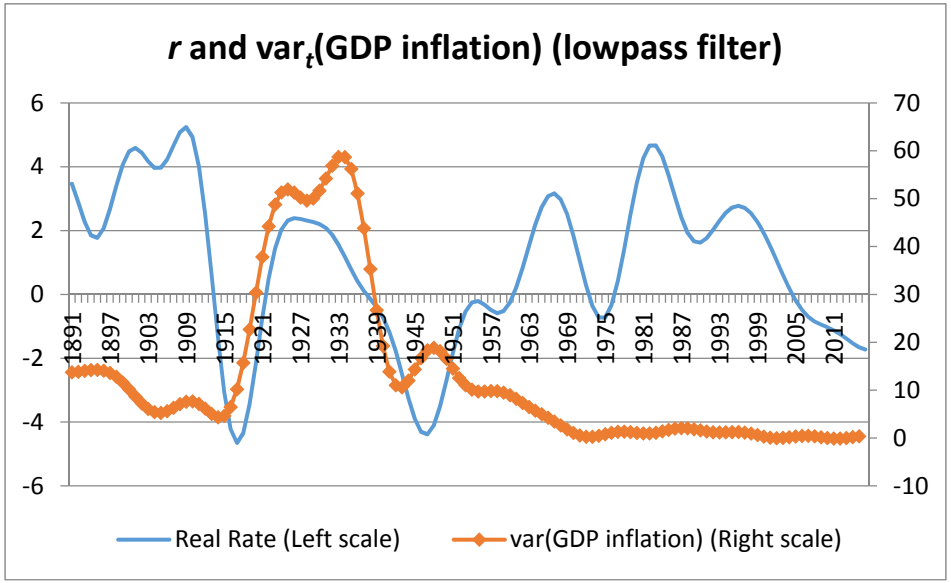

r vs. var_t(per capita NDS growth) (10 yr averages)
r
var(per capita NDS growth)
1986
1996
2006
1976
1966

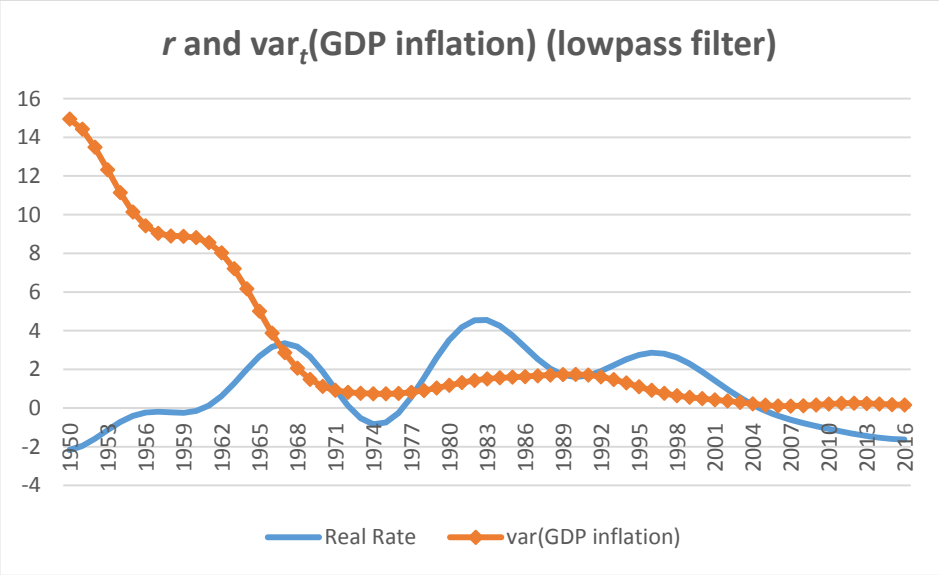

r vs. var_t(per capita NDS growth) (10 yr averages)
r
var(per capita NDS growth)
1986
1996
2006
1976
1966
2016

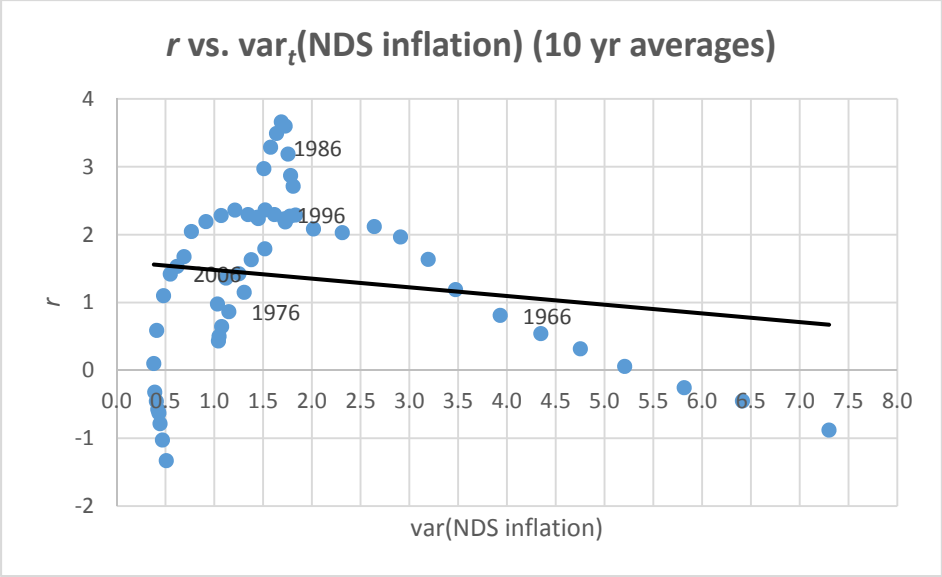

r and var_t(per capita NDS Growth) (lowpass filter)
Real Rate
var(per capita NDS Growth)

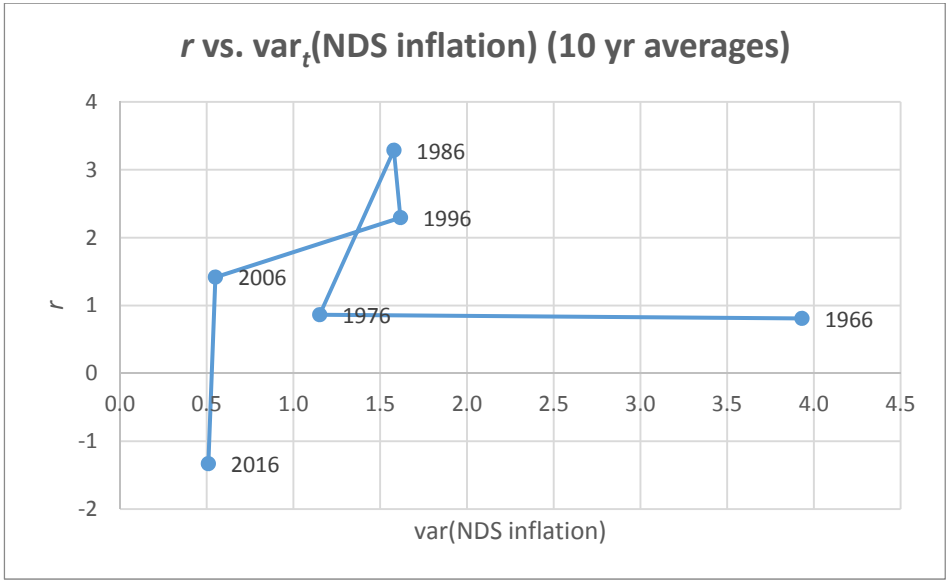

r vs. var_t(GDP inflation) (10 yr averages)
r
var(GDP inflation)
1906
1986
1916
1996
2006
1976
1966
1936
1956
1946
1926

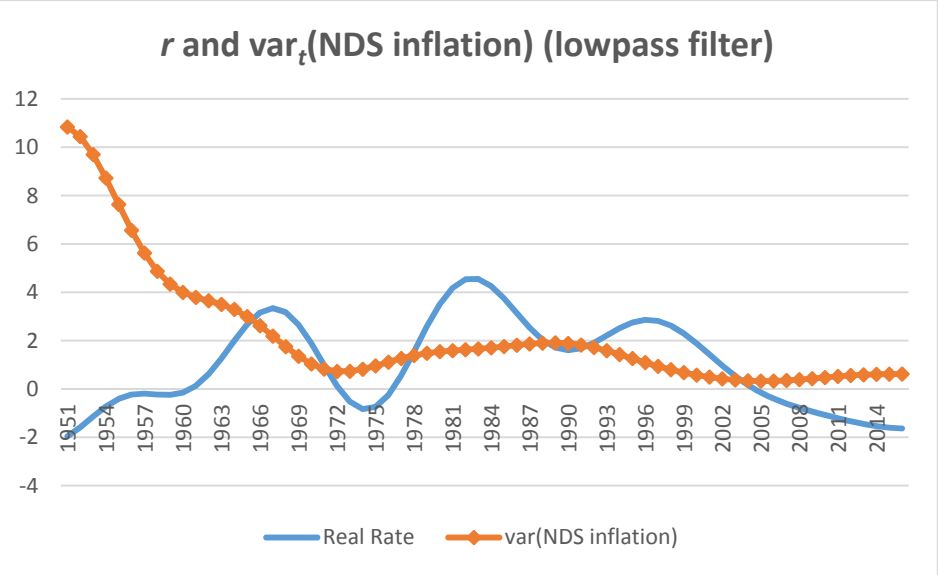

r vs. var_t(GDP inflation) (10 yr averages)
r
var(GDP inflation)
1906
1986
1916
1996
2006
1976
1966
1936
2016
1956
1946
1926

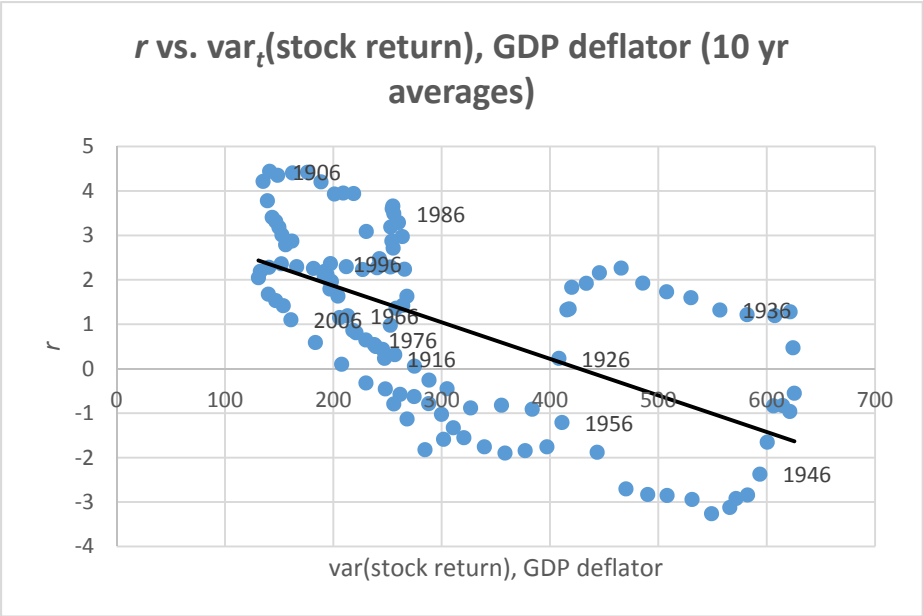

r and var_t(GDP inflation) (lowpass filter)
Real Rate (Left scale)
var(GDP inflation) (Right scale)

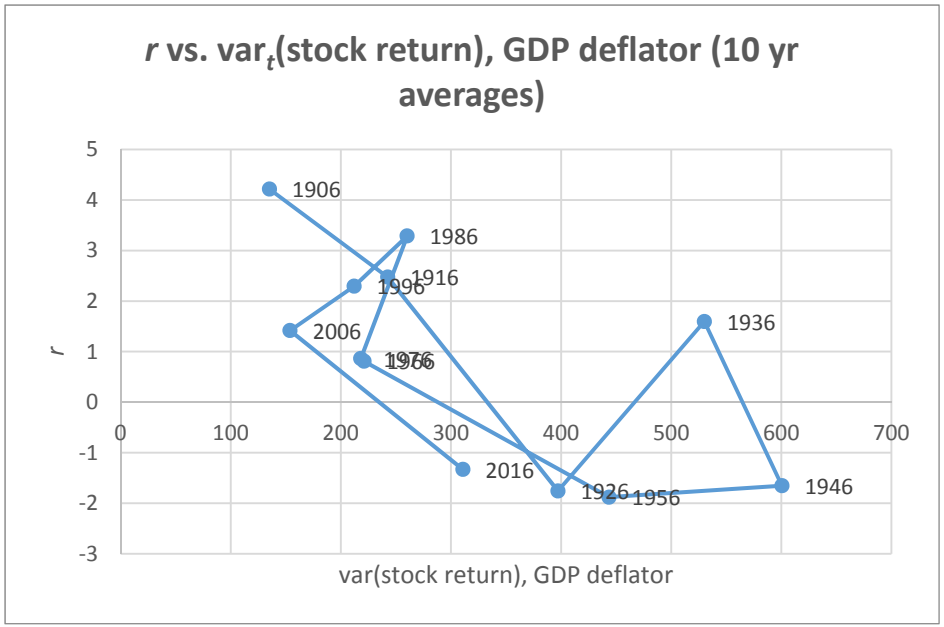

r and var_t(GDP inflation) (lowpass filter)
Real Rate
var(GDP inflation)

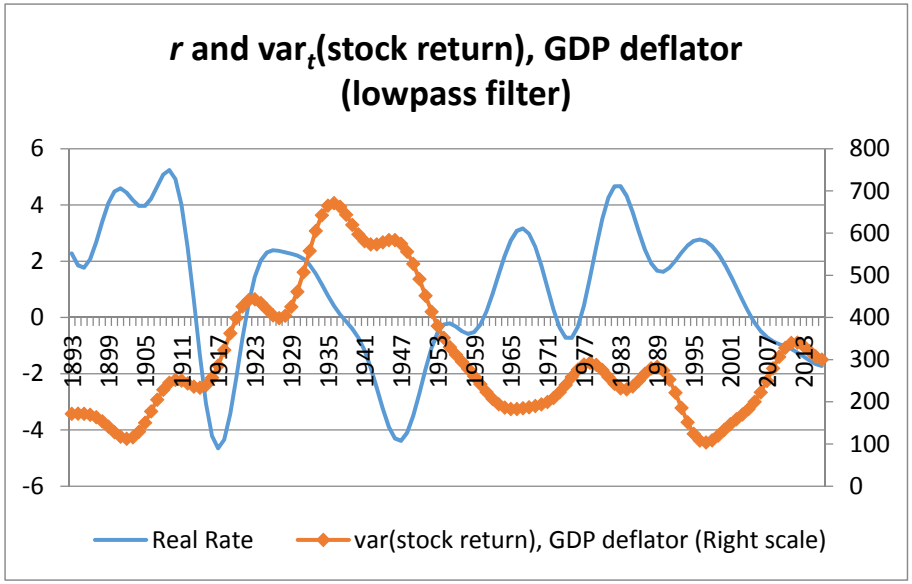

r vs. var_t(NDS inflation) (10 yr averages)
r
var(NDS inflation)
1986
1996
2006
1976
1966

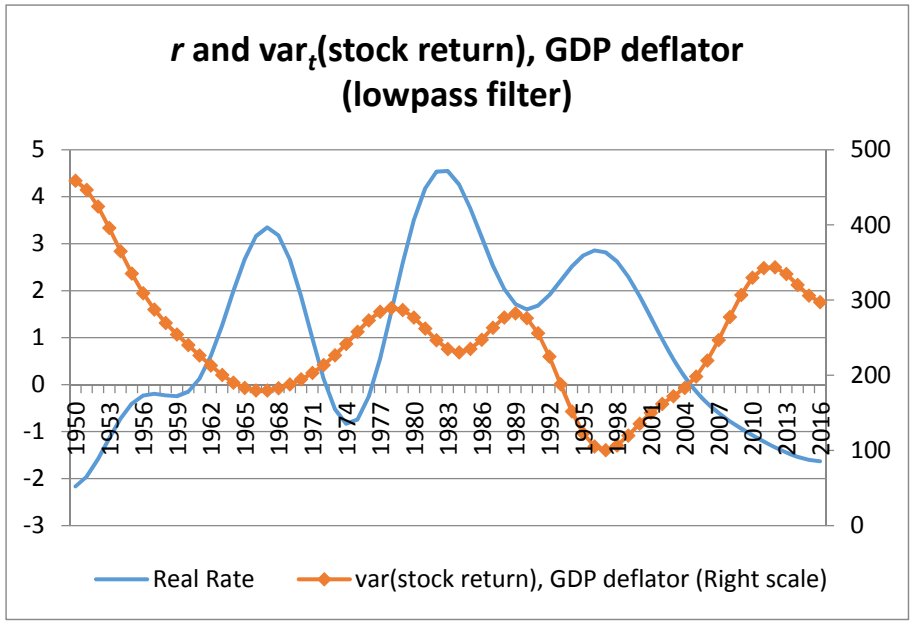

r vs. var_t(NDS inflation) (10 yr averages)
r
var(NDS inflation)
1986
1996
2006
1976
1966
2016

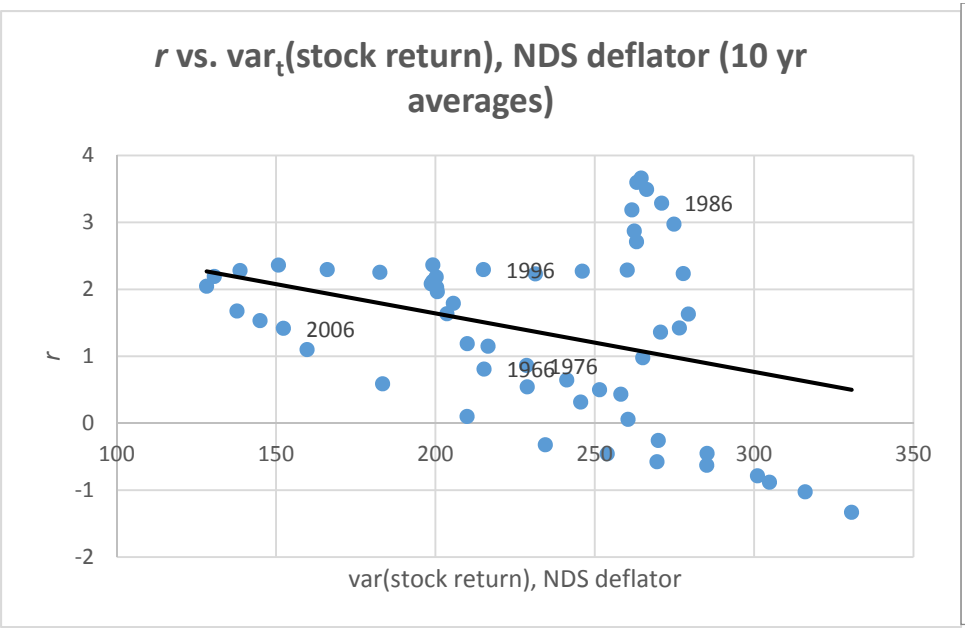

r and var_t(NDS inflation) (lowpass filter)
Real Rate
var(NDS inflation)

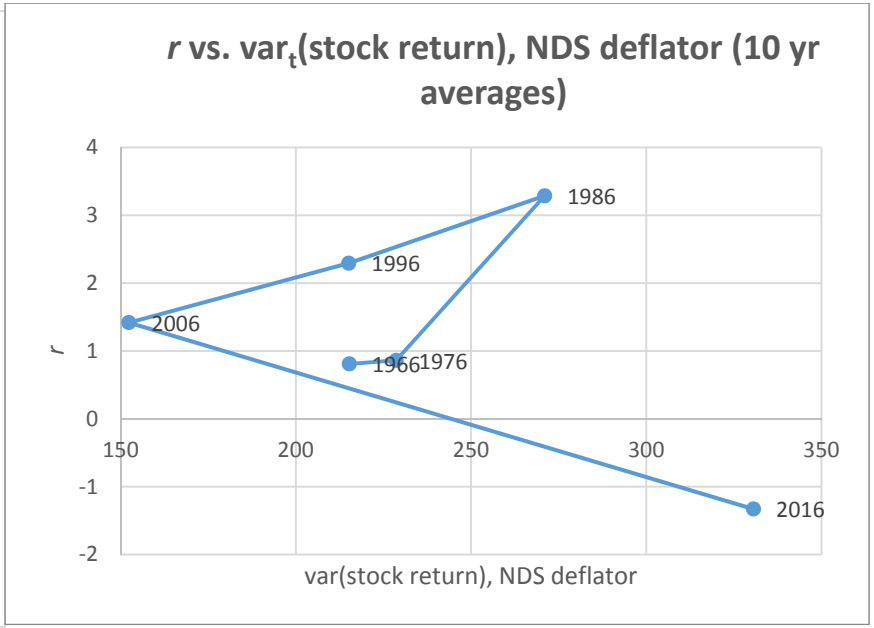

r vs. var_t(stock return), GDP deflator (10 yr averages)
r
var(stock return), GDP deflator
1906
1986
1996
2006
1966
1976
1916
1926
1936
1956
1946

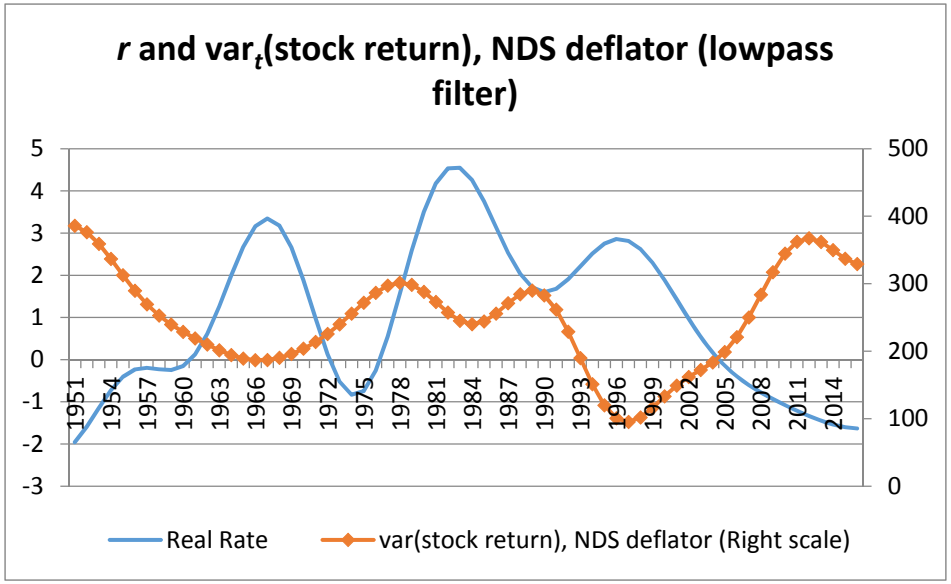

r vs. var_t(stock return), GDP deflator (10 yr averages)
r
var(stock return), GDP deflator
1906
1986
1916
1996
2006
1936
2016
1926
1956
1946

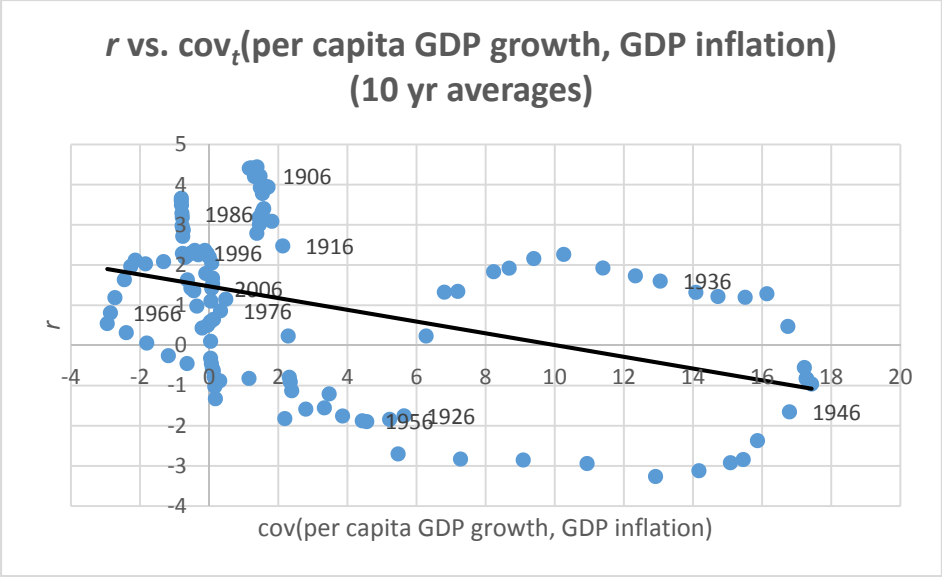

r and var_t(stock return), GDP deflator (lowpass filter)
Real Rate
var(stock return), GDP deflator (Right scale)

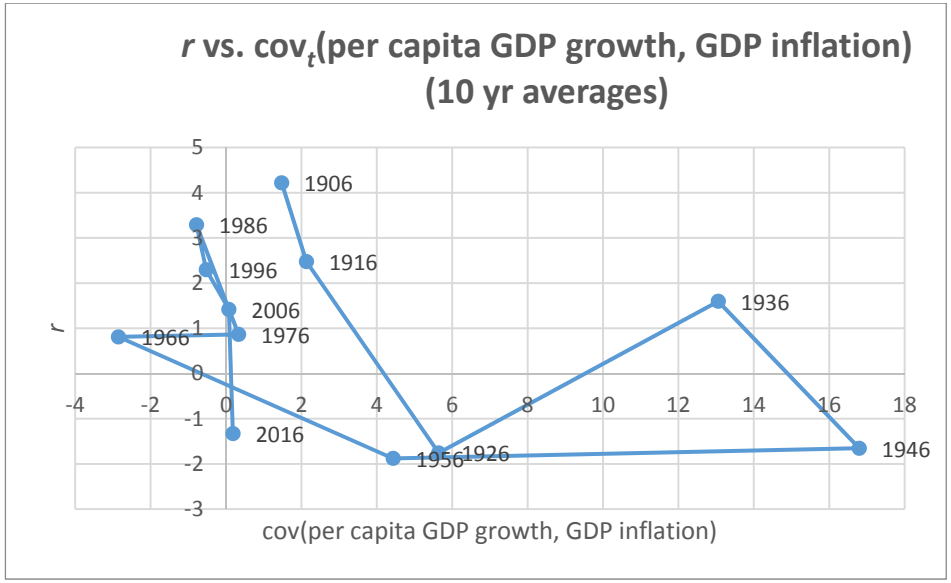

r and var_t(stock return), GDP deflator (lowpass filter)
Real Rate
var(stock return), GDP deflator (Right scale)

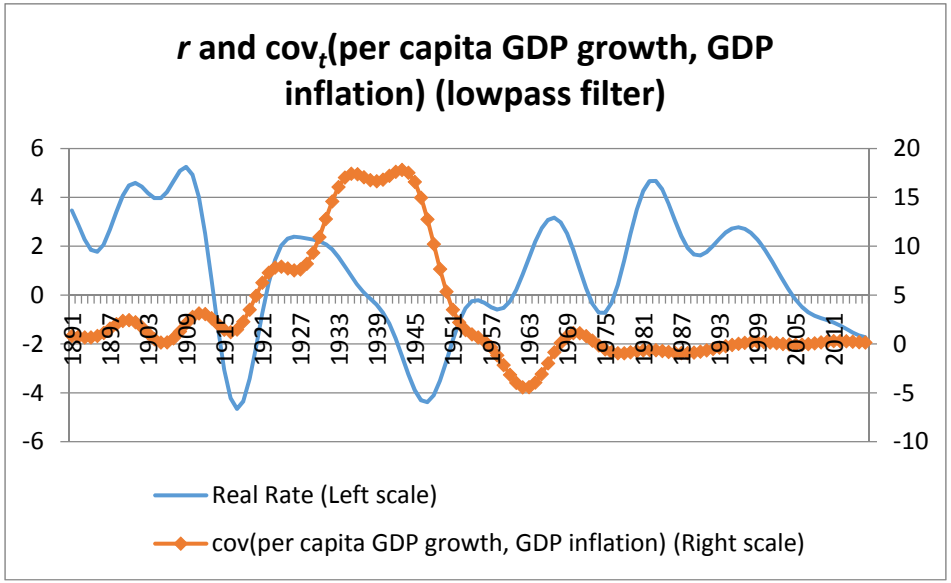

r vs. var_t(stock return), NDS deflator (10 yr averages)
r
var(stock return), NDS deflator
1986
1996
2006
1966
1976

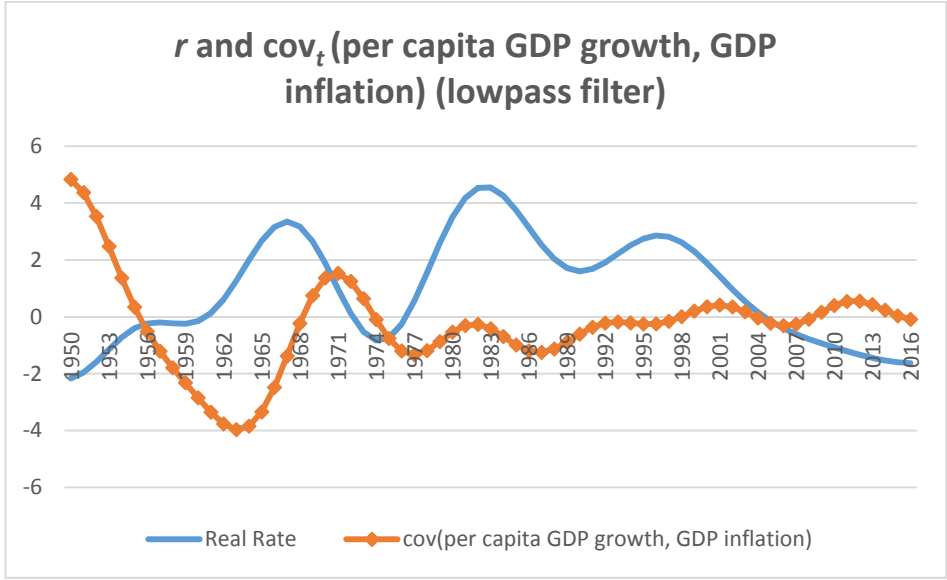

r vs. var_t(stock return), NDS deflator (10 yr averages)
r
var(stock return), NDS deflator
1986
1996
2006
1966
1976
2016

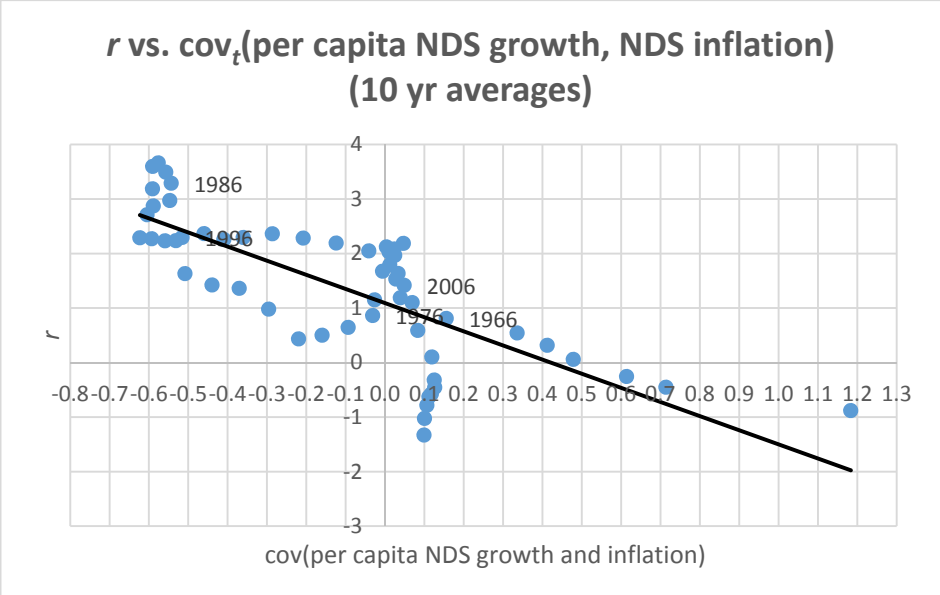

r and var_t(stock return), NDS deflator (lowpass filter)
Real Rate
var(stock return), NDS deflator (Right scale)

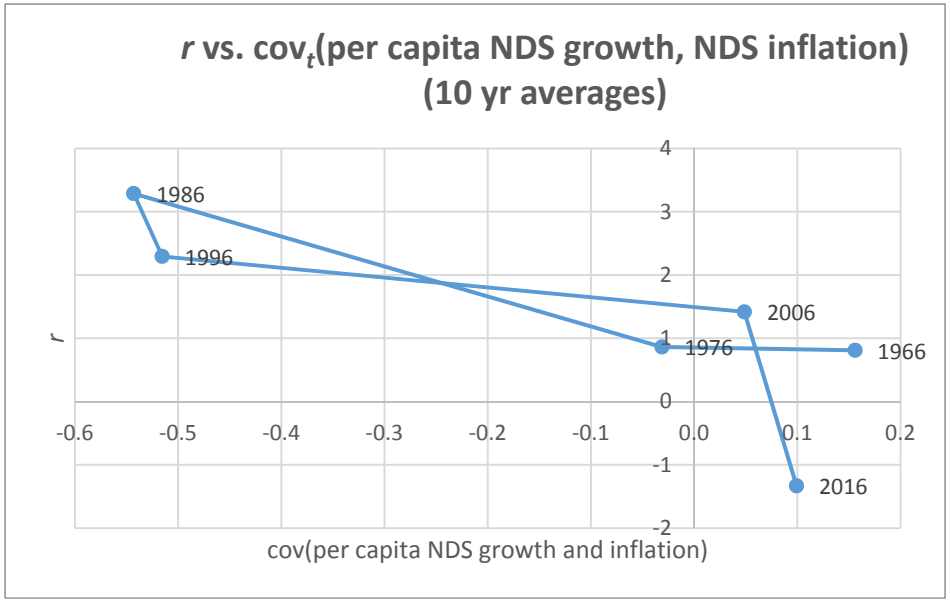

r vs. cov_t(per capita GDP growth, GDP inflation) (10 yr averages)
r
cov(per capita GDP growth, GDP inflation)
1906
1986
1996
1916
2006
1966
1976
1936
1956
1926
1946

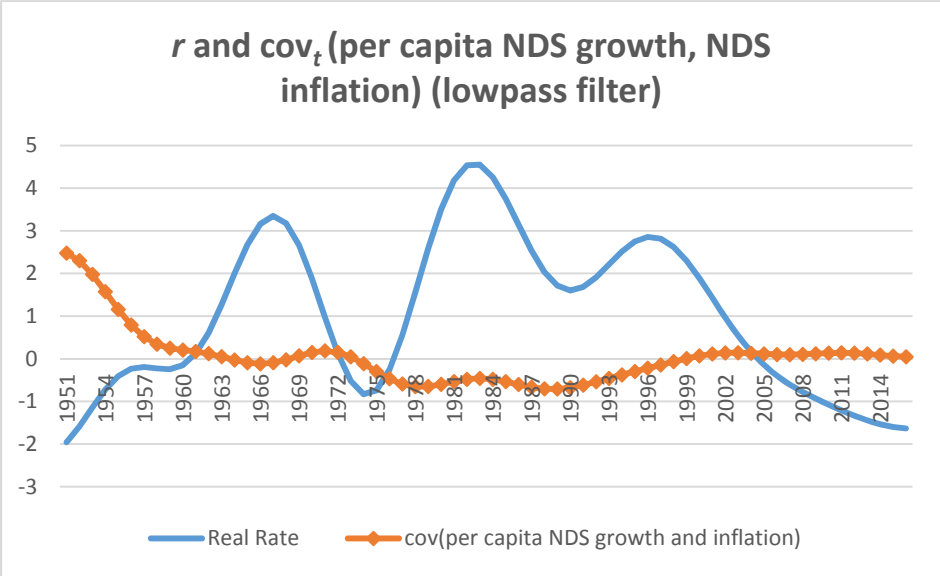

r vs. cov_t(per capita GDP growth, GDP inflation) (10 yr averages)
r
cov(per capita GDP growth, GDP inflation)
1906
1986
1996
1916
2006
1936
1966
1976
2016
1956
1926
1946

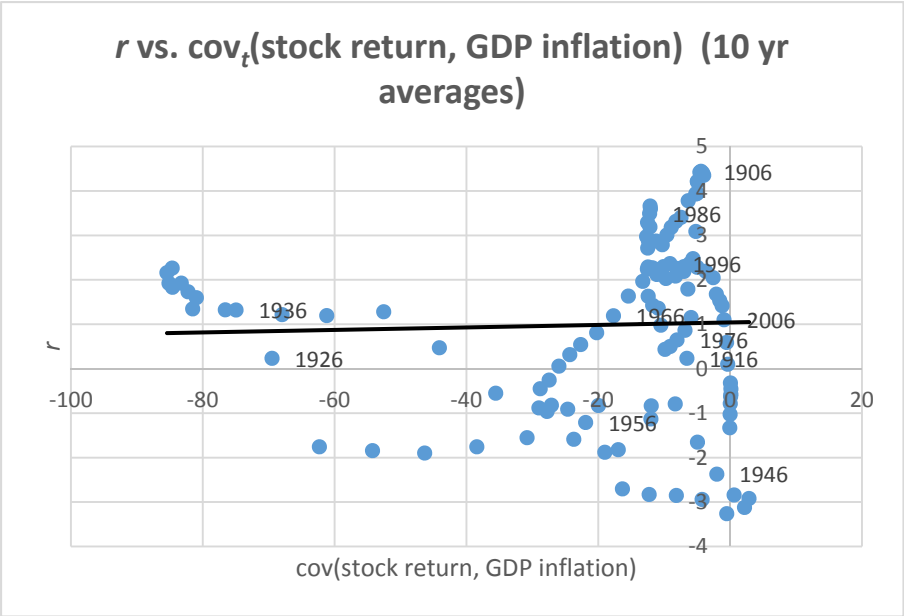

r and cov_t(per capita GDP growth, GDP inflation) (lowpass filter)
Real Rate (Left scale)
cov(per capita GDP growth, GDP inflation) (Right scale)

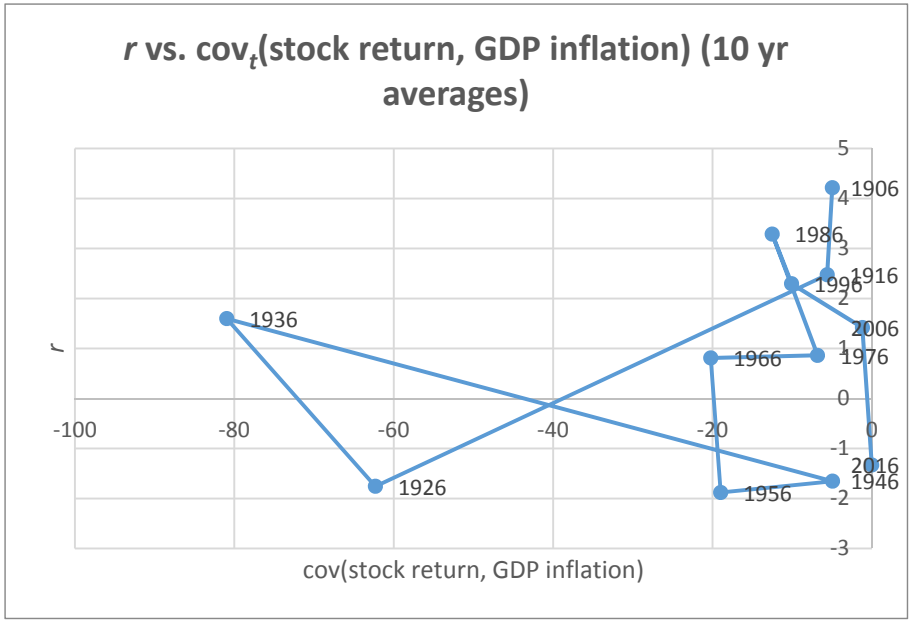

r and cov_t (per capita GDP growth, GDP inflation) (lowpass filter)
Real Rate
cov(per capita GDP growth, GDP inflation)

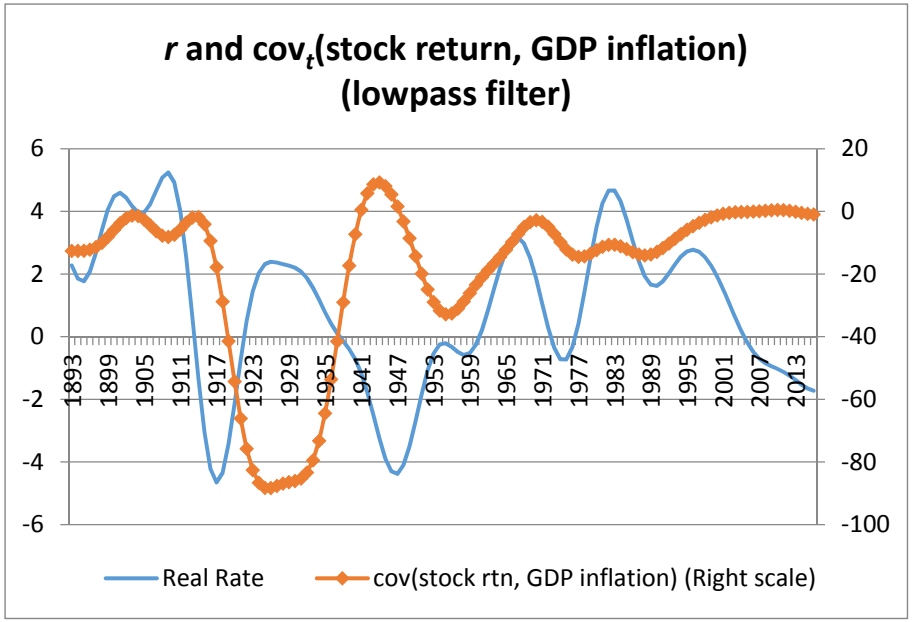

r vs. covt(per capita NDS growth, NDS inflation)
(10 yr averages)
r
1986
1996
2006
1976
1966
cov(per capita NDS growth and inflation)

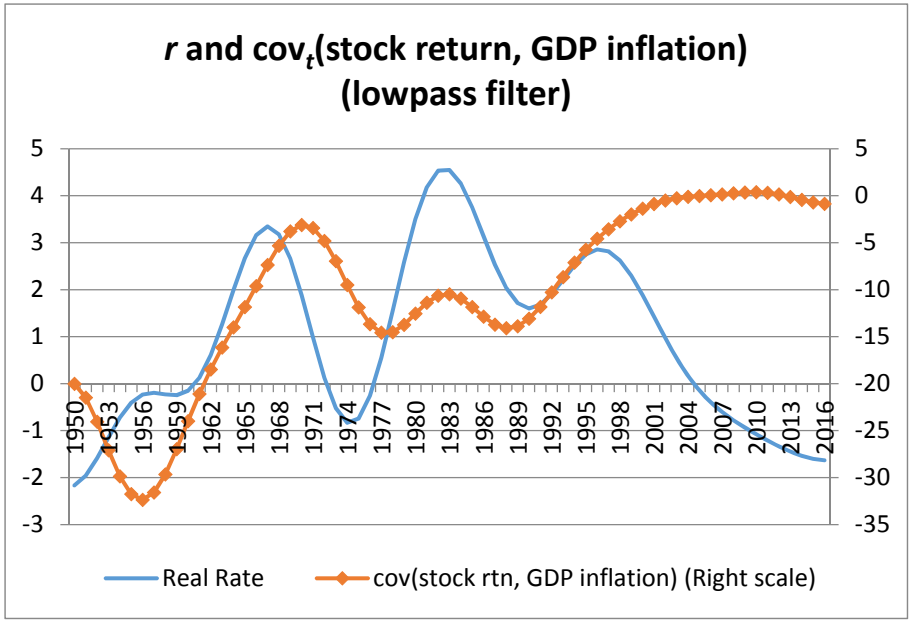

r vs. covt(per capita NDS growth, NDS inflation)
(10 yr averages)
r
1986
1996
2006
1976
1966
2016
cov(per capita NDS growth and inflation)

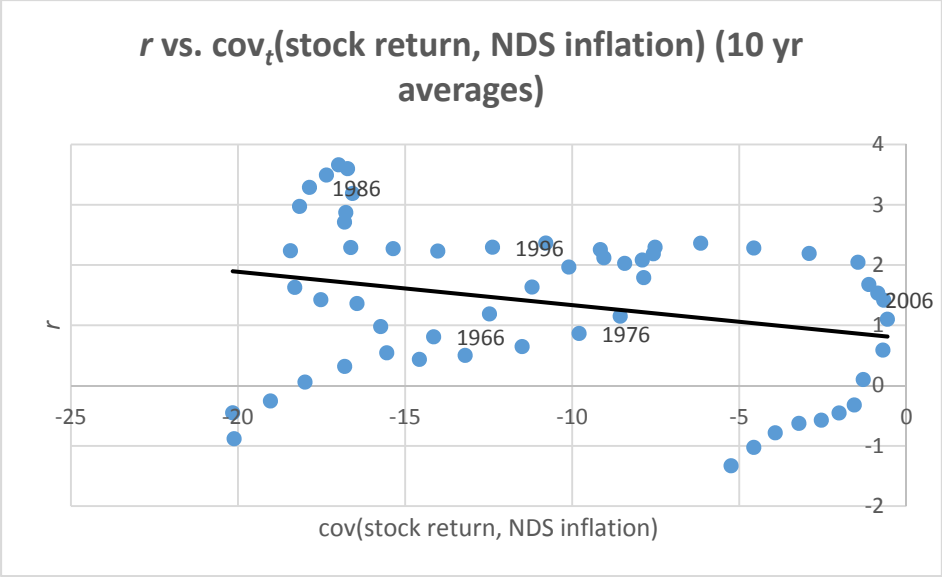

r and covt (per capita NDS growth, NDS inflation) (lowpass filter)
Real Rate
cov(per capita NDS growth and inflation)

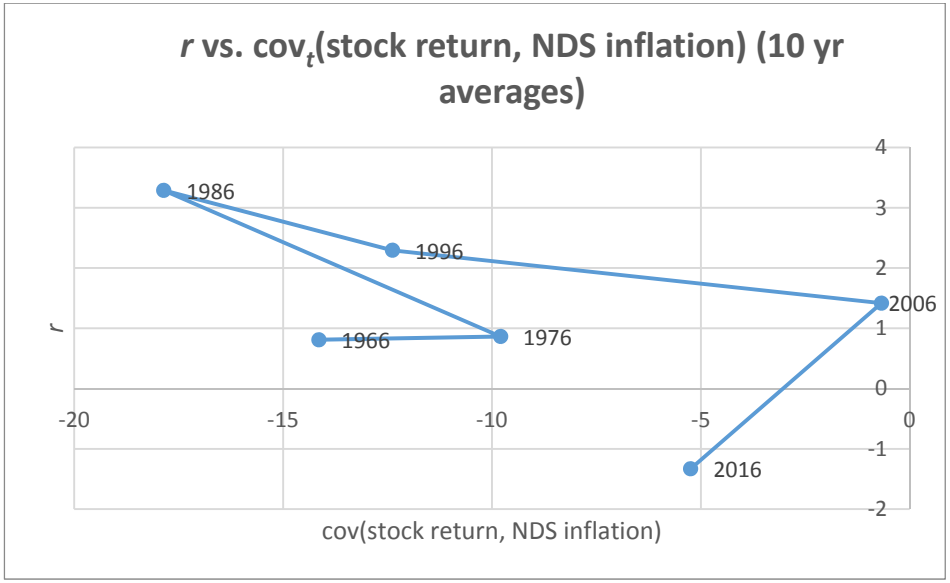

r vs. covt(stock return, GDP inflation) (10 yr averages)
r
cov(stock return, GDP inflation)
1906
1986
1996
2006
1976
1916
1936
1926
1966
1956
1946
-100
-80
-60
-40
-20
0
20
5
4
3
2
1
0
-1
-2
-3
-4

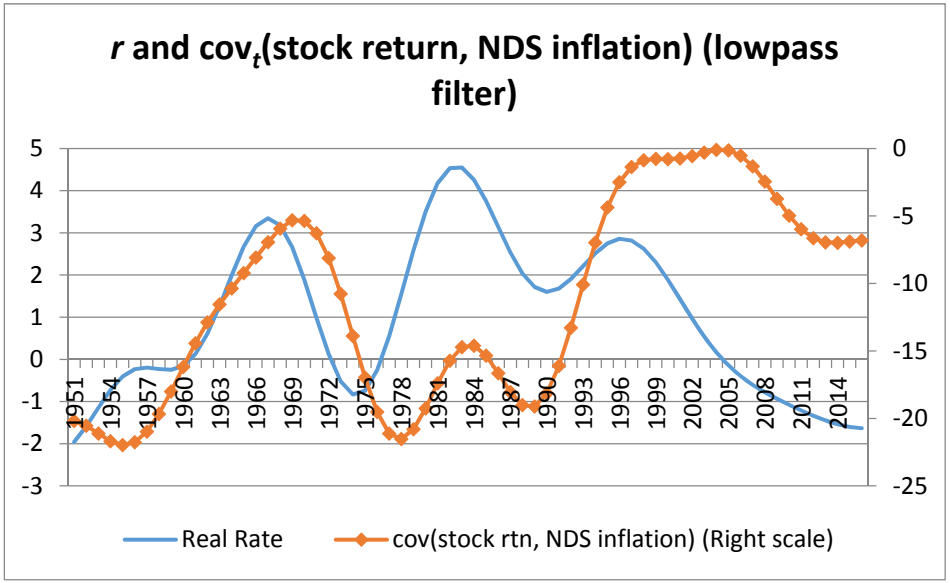

r vs. covt(stock return, GDP inflation) (10 yr averages)
r
cov(stock return, GDP inflation)
1906
1986
1916
1996
2006
1976
1936
1966
1926
1956
1946
2016
-100
-80
-60
-40
-20
0
5
4
3
2
1
0
-1
-2
-3

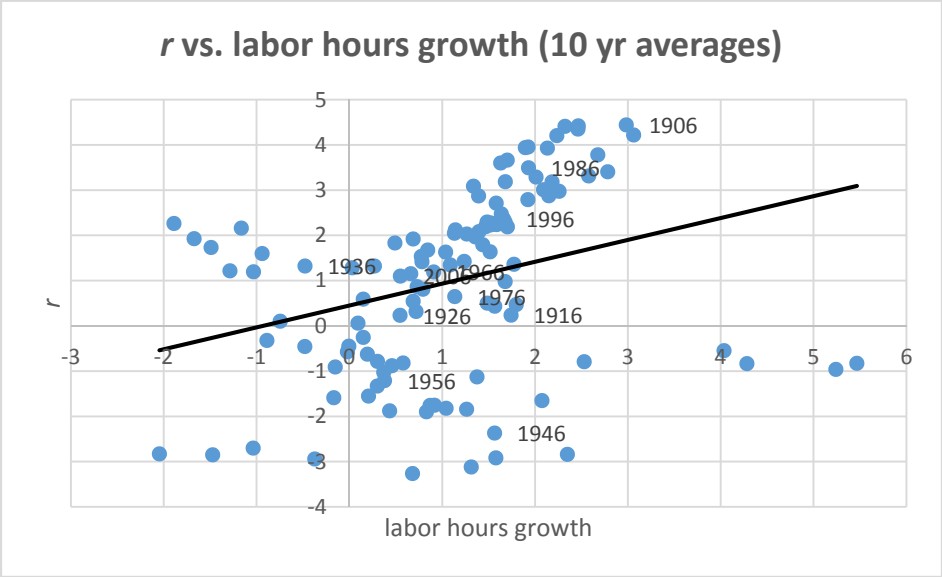

r and covt(stock return, GDP inflation) (lowpass filter)
Real Rate
cov(stock rtn, GDP inflation) (Right scale)
6
4
2
0
-2
-4
-6
20
0
-20
-40
-60
-80
-100
1893
1899
1905
1911
1917
1923
1929
1935
1941
1947
1953
1959
1965
1971
1977
1983
1989
1995
2001
2007
2013

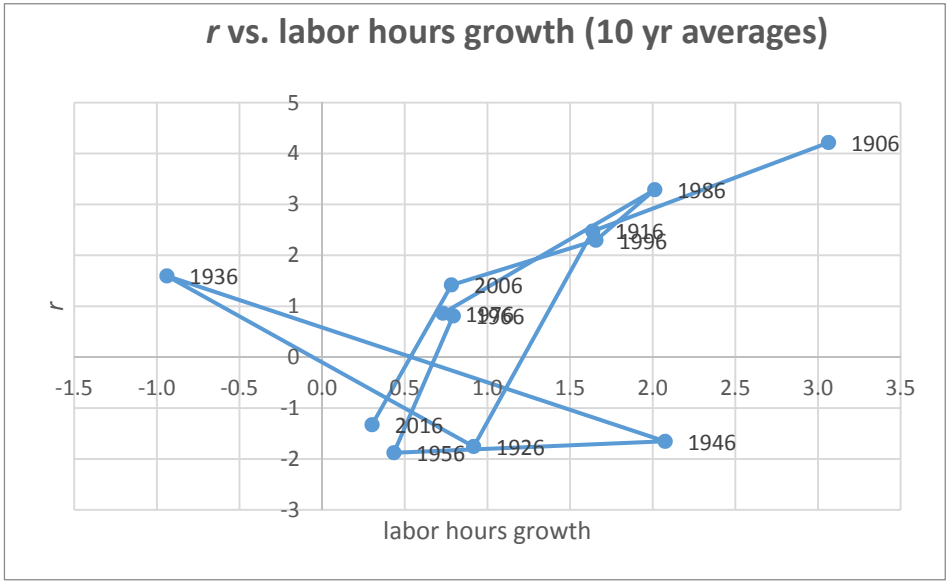

r and covt(stock return, GDP inflation) (lowpass filter)
Real Rate
cov(stock rtn, GDP inflation) (Right scale)
5
4
3
2
1
0
-1
-2
-3
0
-5
-10
-15
-20
-25
-30
-35
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
2016

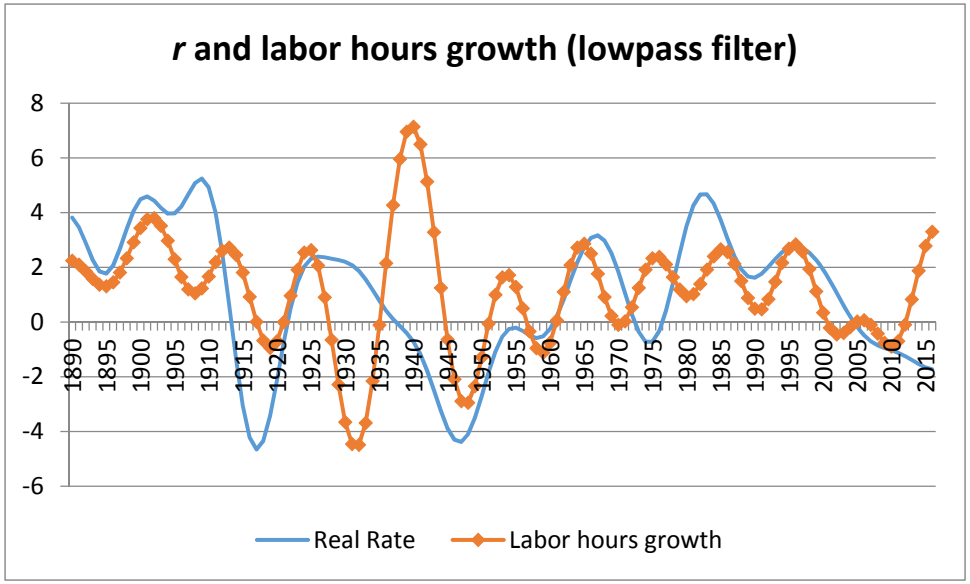

r vs. covt(stock return, NDS inflation) (10 yr averages)
1986
1996
2006
1966
1976
r
cov(stock return, NDS inflation)

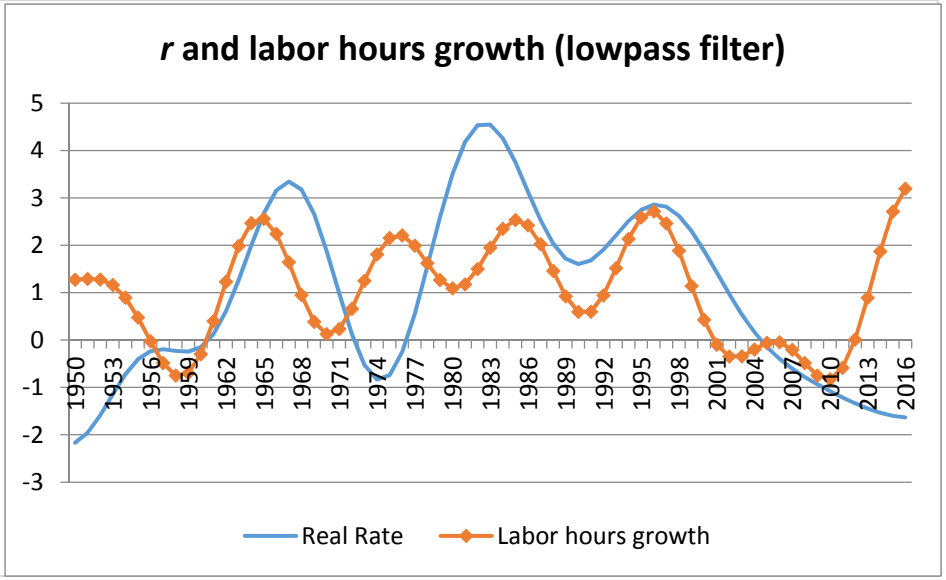

r vs. covt(stock return, NDS inflation) (10 yr averages)
1986
1996
2006
1966
1976
2016
r
cov(stock return, NDS inflation)

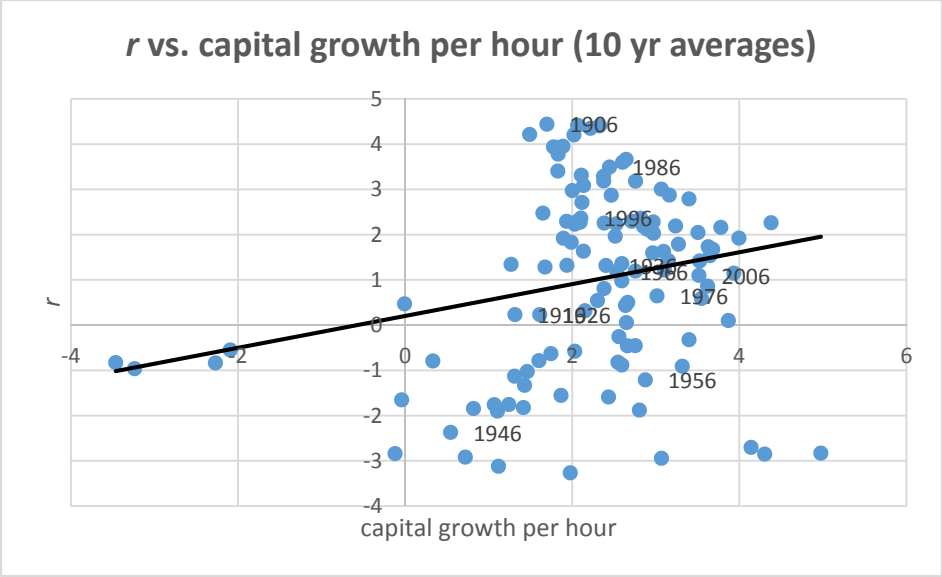

r and covt(stock return, NDS inflation) (lowpass filter)
Real Rate
cov(stock rtn, NDS inflation) (Right scale)

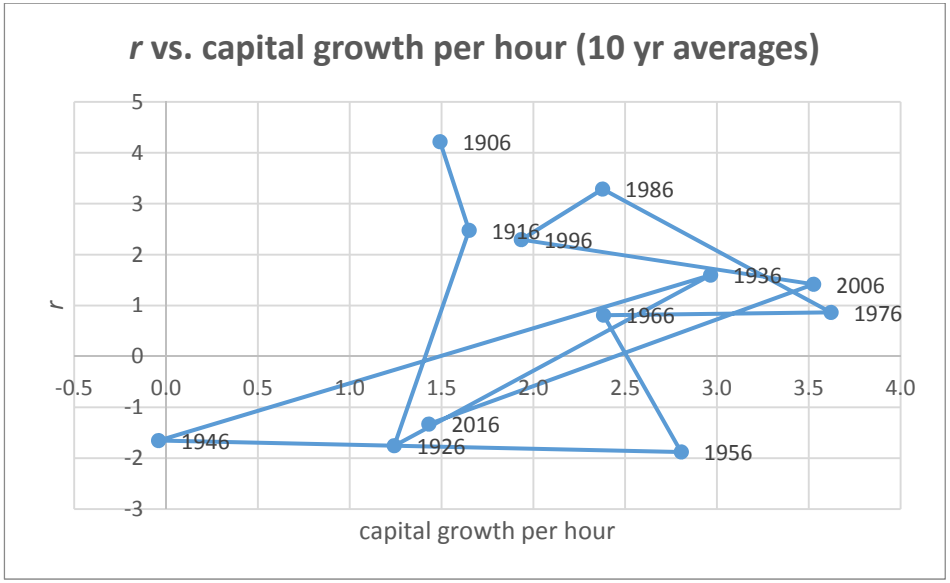

r vs. labor hours growth (10 yr averages)
r
labor hours growth
1906
1986
1996
1936
1966
2006
1976
1926
1916
1956
1946

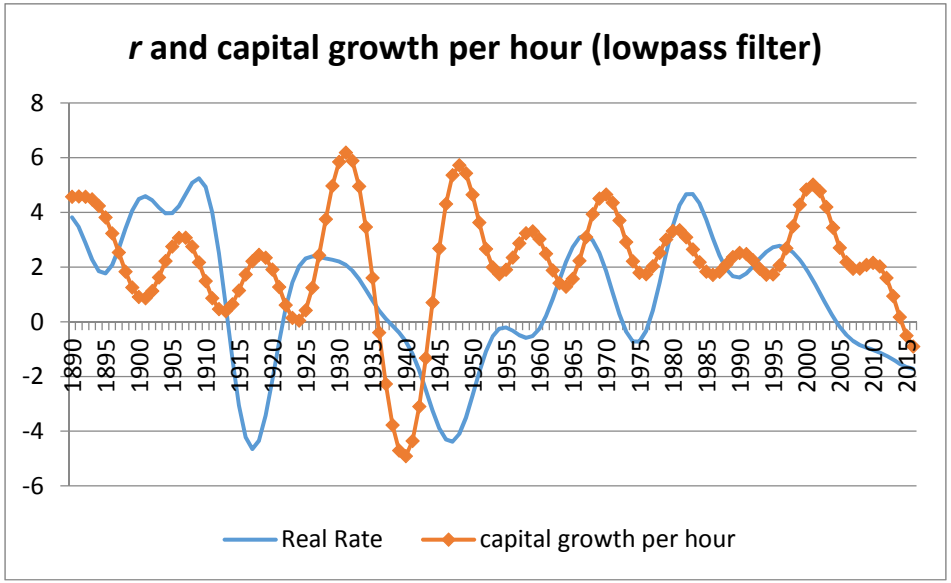

r vs. labor hours growth (10 yr averages)
r
labor hours growth
1906
1986
1916
1996
1936
2006
1976
1966
2016
1956
1926
1946

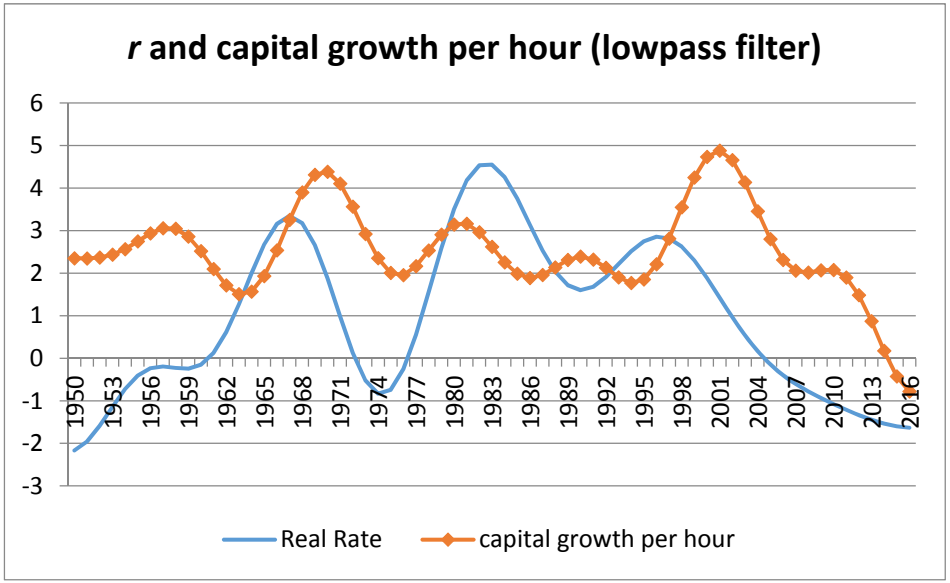

r and labor hours growth (lowpass filter)
Real Rate
Labor hours growth

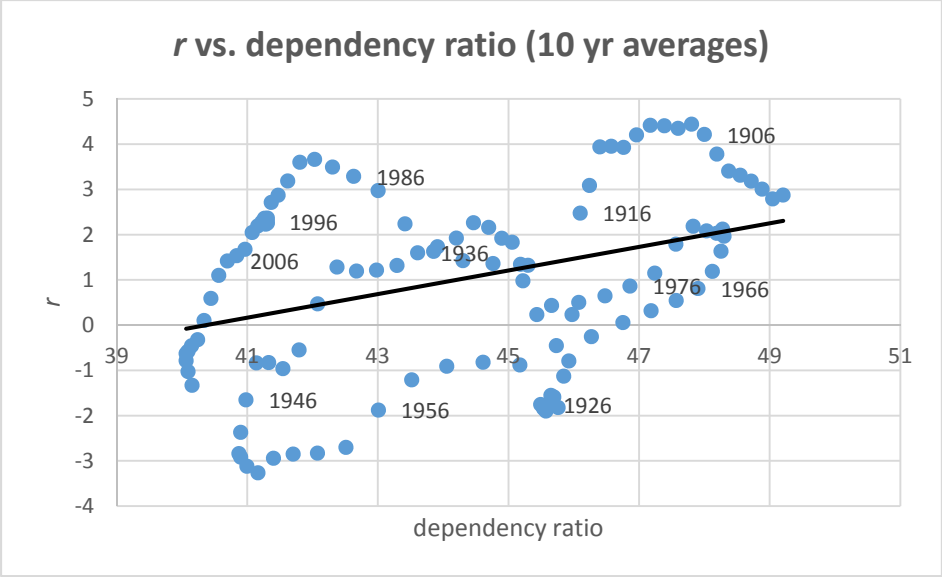

r and labor hours growth (lowpass filter)
Real Rate
Labor hours growth

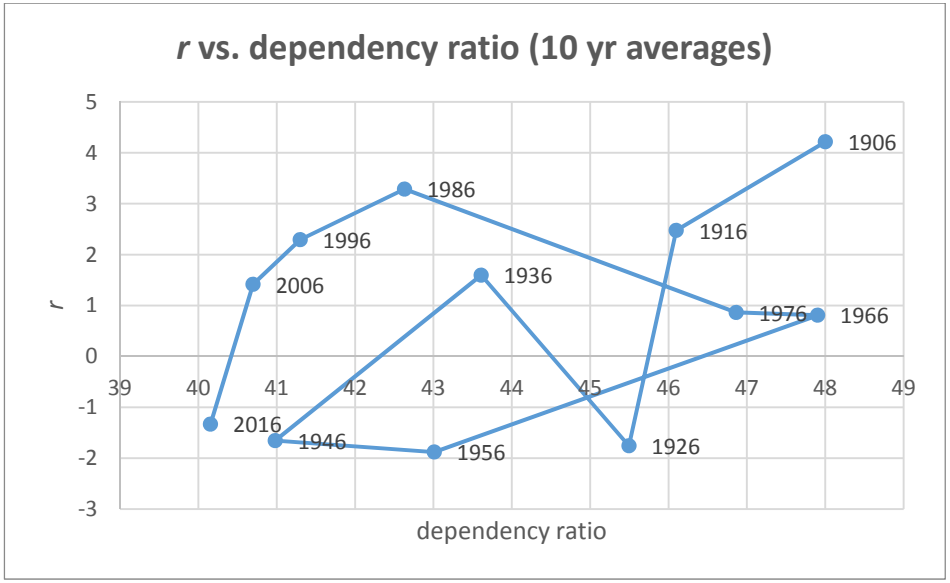

r vs. capital growth per hour (10 yr averages)
r
capital growth per hour
1906
1986
1996
1916
1936
1966
2006
1976
1926
1956
1946

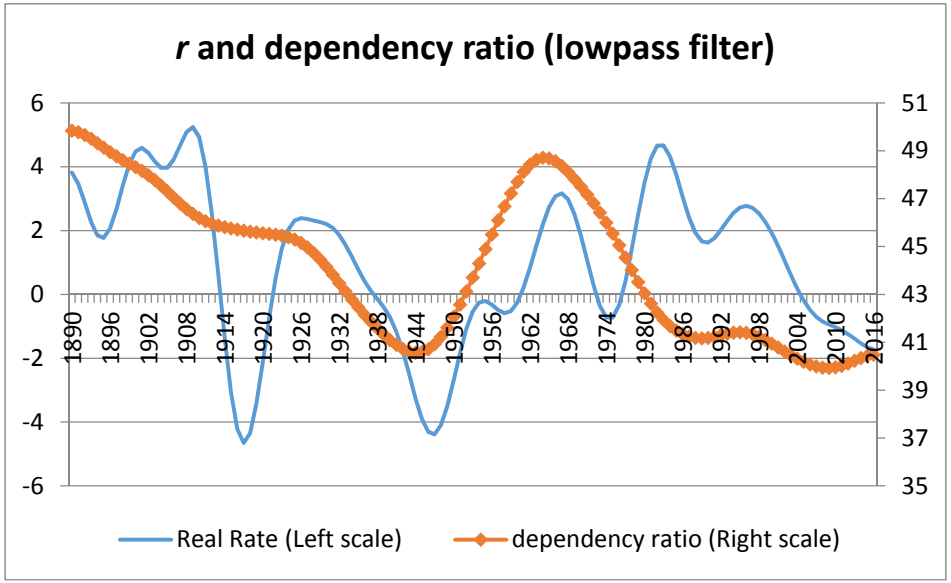

r vs. capital growth per hour (10 yr averages)
r
capital growth per hour
1906
1986
1916
1996
1936
2006
1966
1976
2016
1946
1926
1956

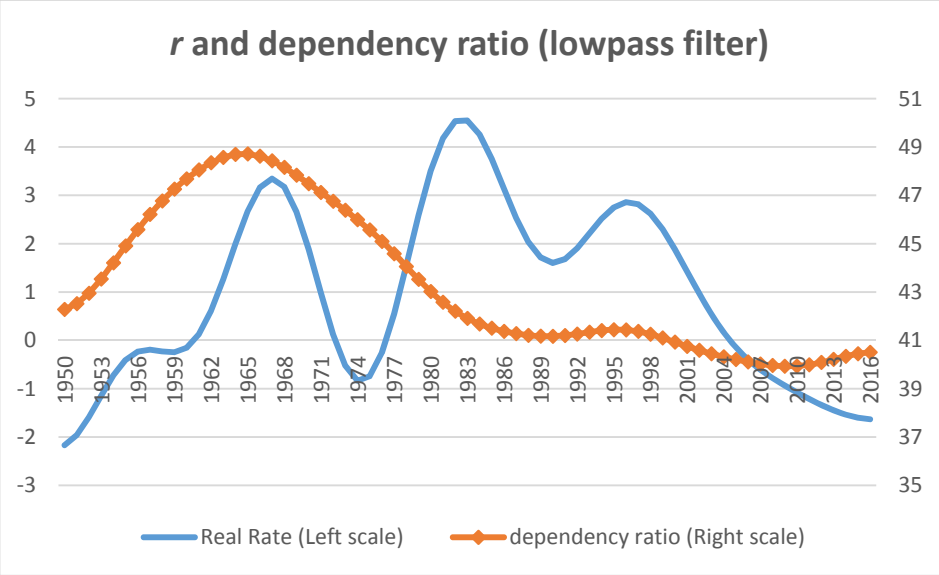

r and capital growth per hour (lowpass filter)
Real Rate
capital growth per hour

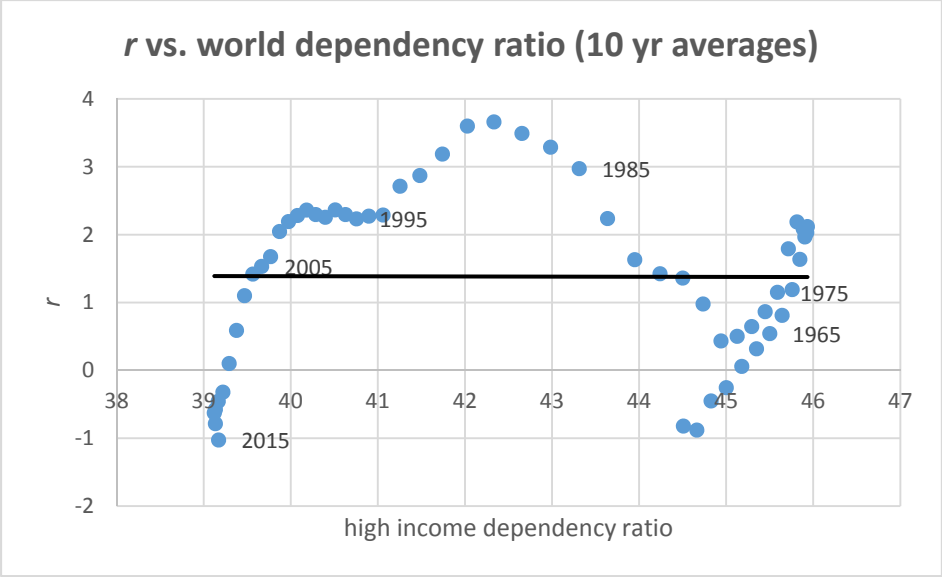

r and capital growth per hour (lowpass filter)
Real Rate
capital growth per hour

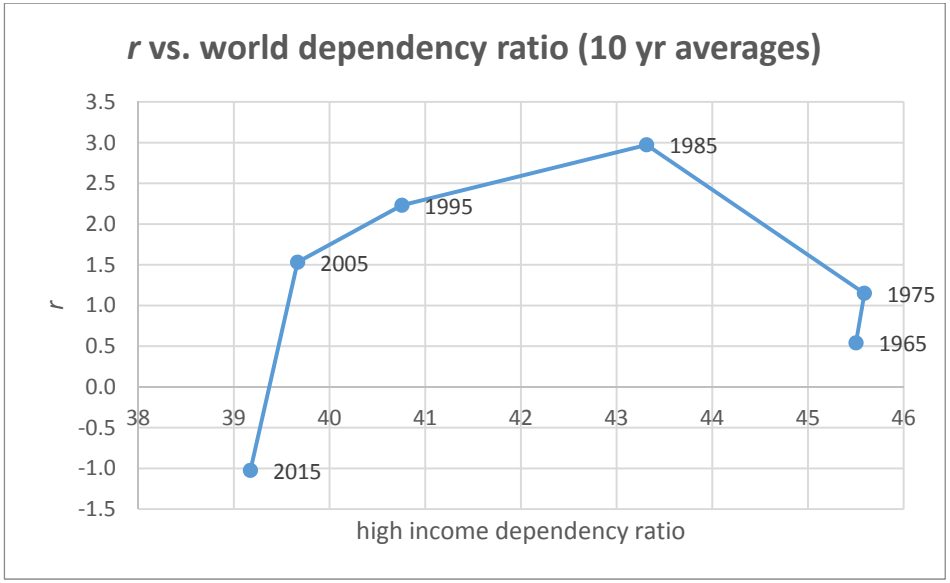

r vs. dependency ratio (10 yr averages)
r
dependency ratio
1906
1986
1996
1916
2006
1936
1976
1966
1946
1956
1926

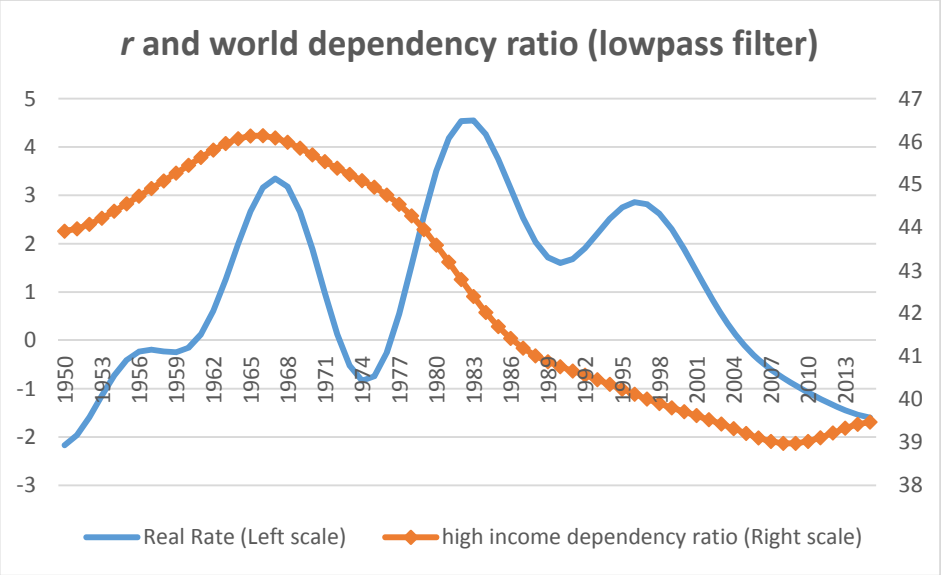

r vs. dependency ratio (10 yr averages)
r
dependency ratio
1906
1986
1996
1916
2006
1936
1976
1966
2016
1946
1956
1926

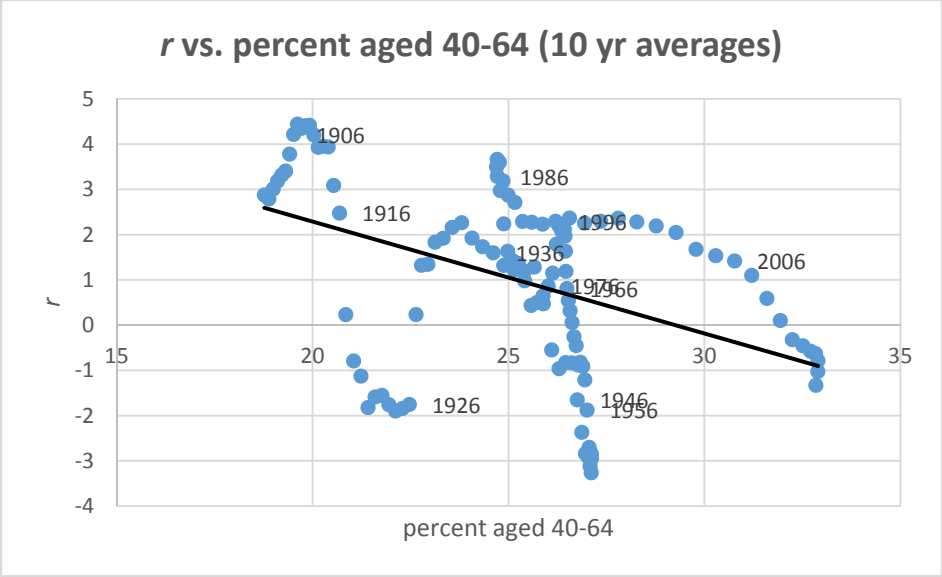

r and dependency ratio (lowpass filter)
Real Rate (Left scale)
dependency ratio (Right scale)

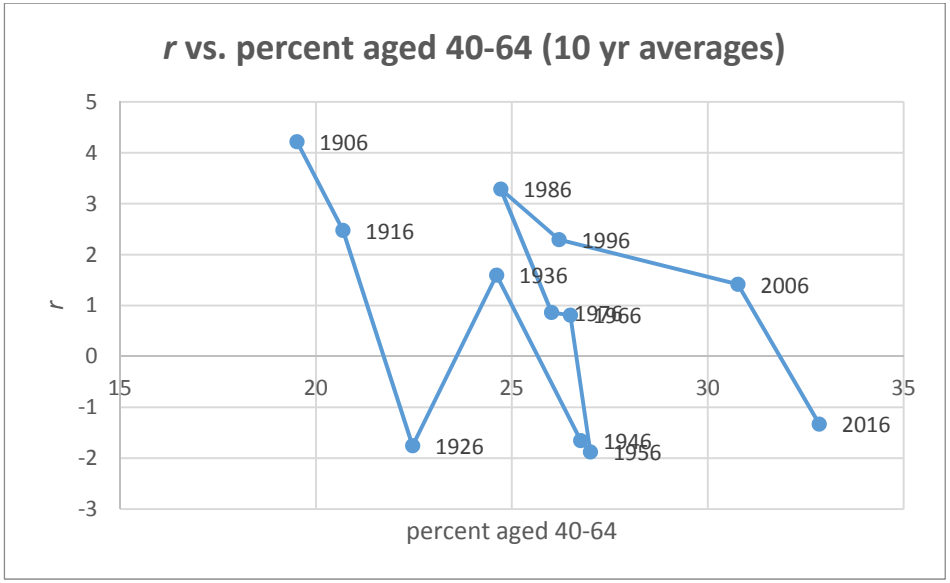

r and dependency ratio (lowpass filter)
Real Rate (Left scale)
dependency ratio (Right scale)

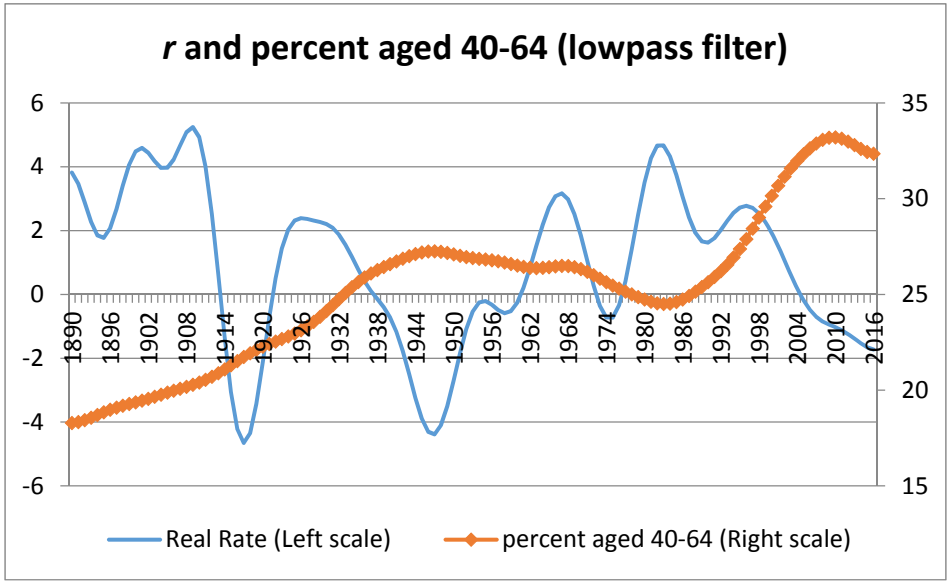

r vs. world dependency ratio (10 yr averages)
r
high income dependency ratio
1985
1995
2005
1975
1965
2015

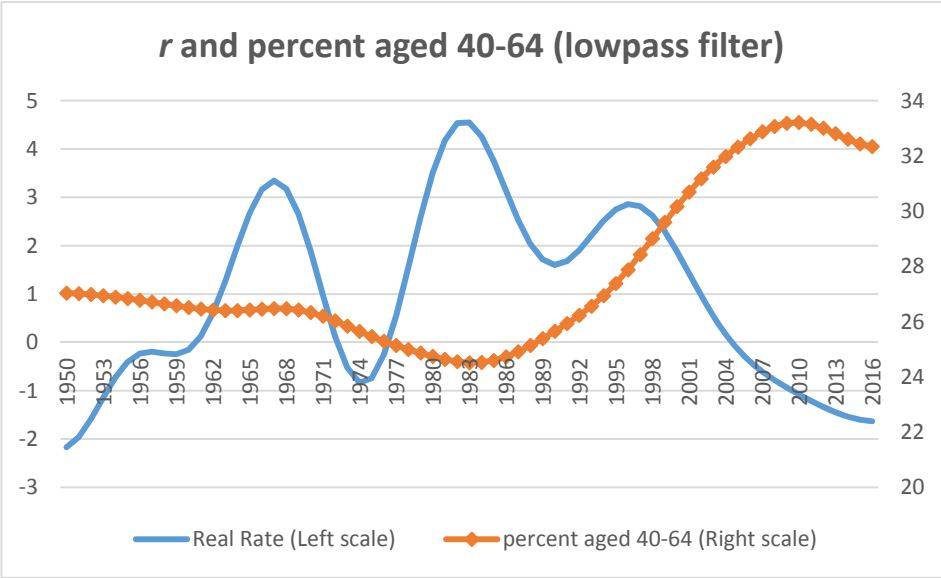

r vs. world dependency ratio (10 yr averages)
r
high income dependency ratio
1985
1995
2005
1975
1965
2015

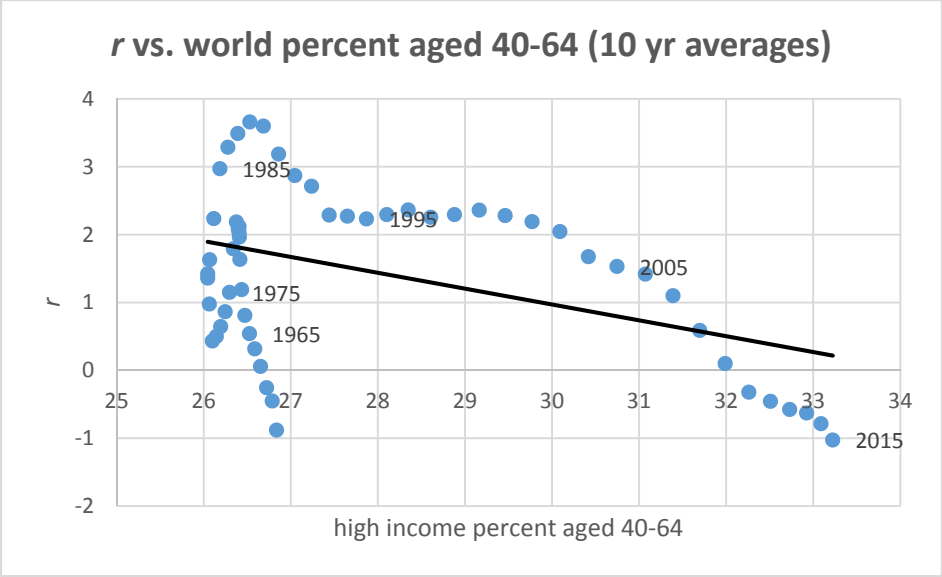

r and world dependency ratio (lowpass filter)
Real Rate (Left scale)
high income dependency ratio (Right scale)

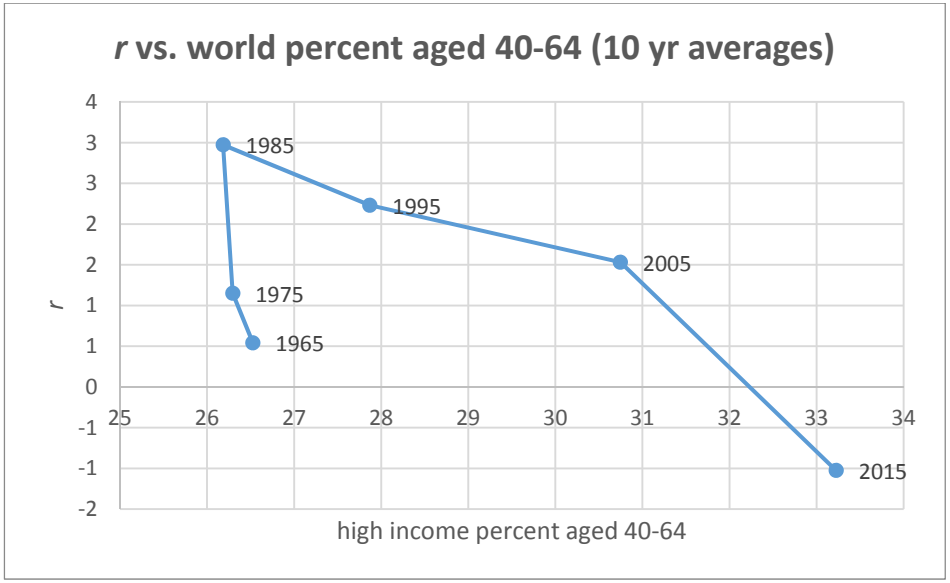

r vs. percent aged 40-64 (10 yr averages)
r
percent aged 40-64
1906
1916
1926
1936
1946
1956
1966
1976
1986
1996
2006

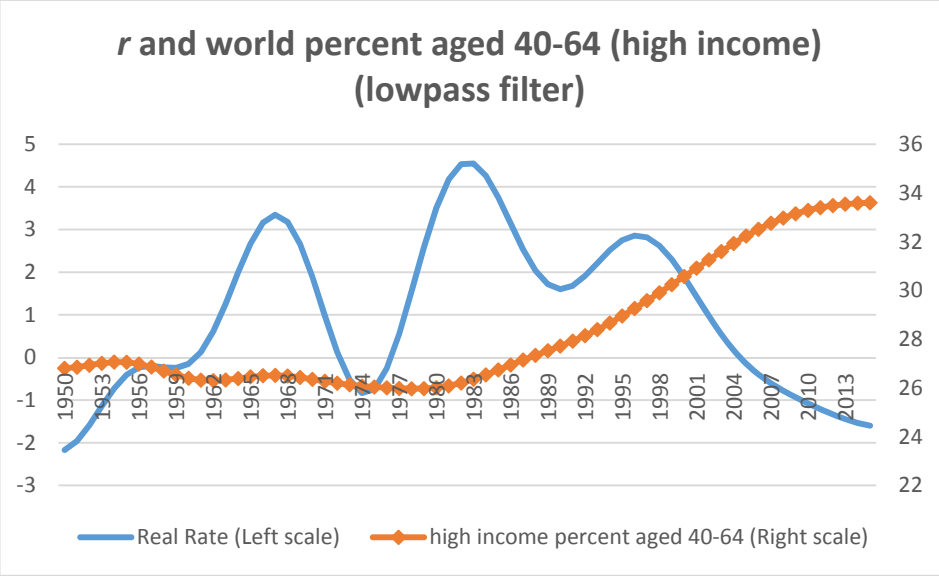

r vs. percent aged 40-64 (10 yr averages)
r
percent aged 40-64
1906
1916
1926
1936
1946
1956
1966
1976
1986
1996
2006
2016

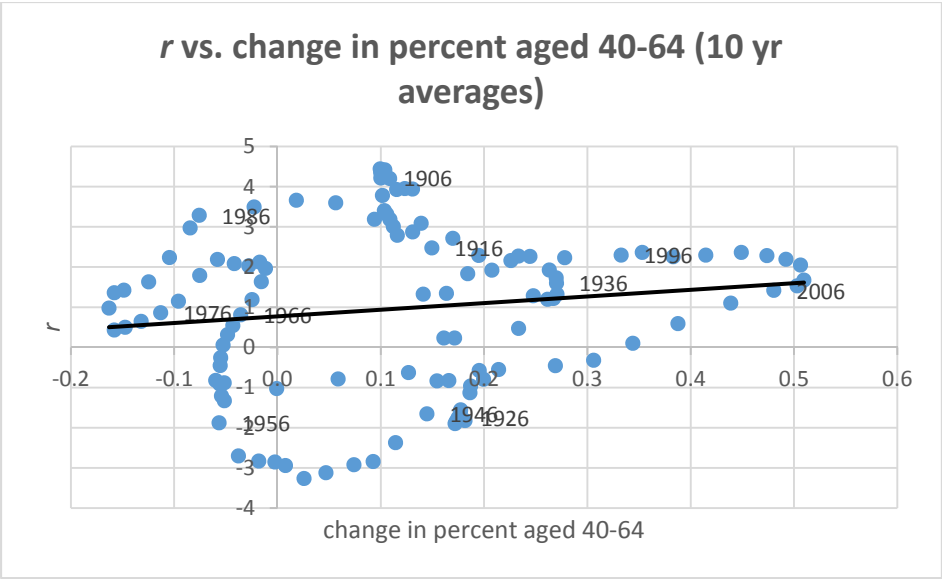

r and percent aged 40-64 (lowpass filter)
Real Rate (Left scale)
percent aged 40-64 (Right scale)

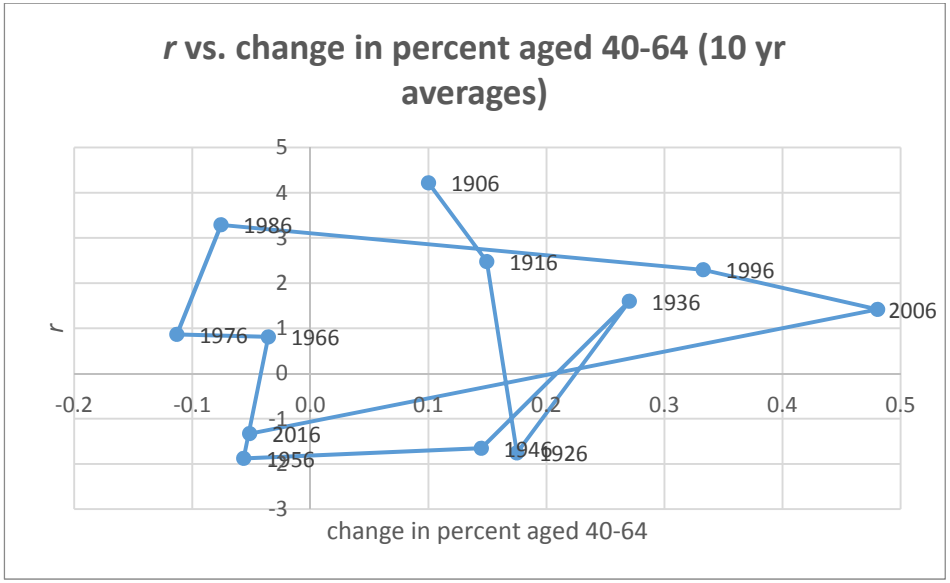

r and percent aged 40-64 (lowpass filter)
Real Rate (Left scale)
percent aged 40-64 (Right scale)

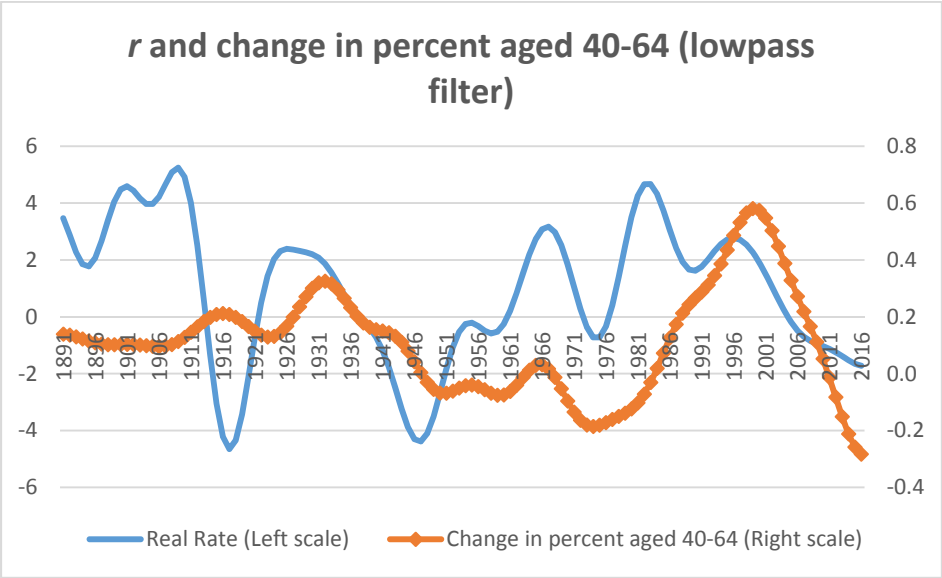

r vs. world percent aged 40-64 (10 yr averages)
r
high income percent aged 40-64
1985
1995
2005
1975
1965
2015

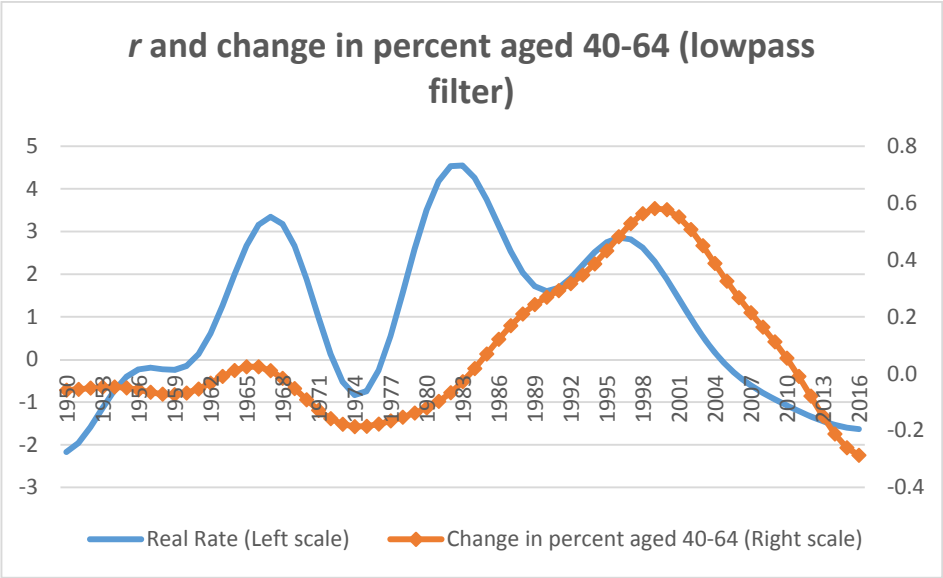

r vs. world percent aged 40-64 (10 yr averages)
r
high income percent aged 40-64
1985
1995
2005
1975
1965
2015

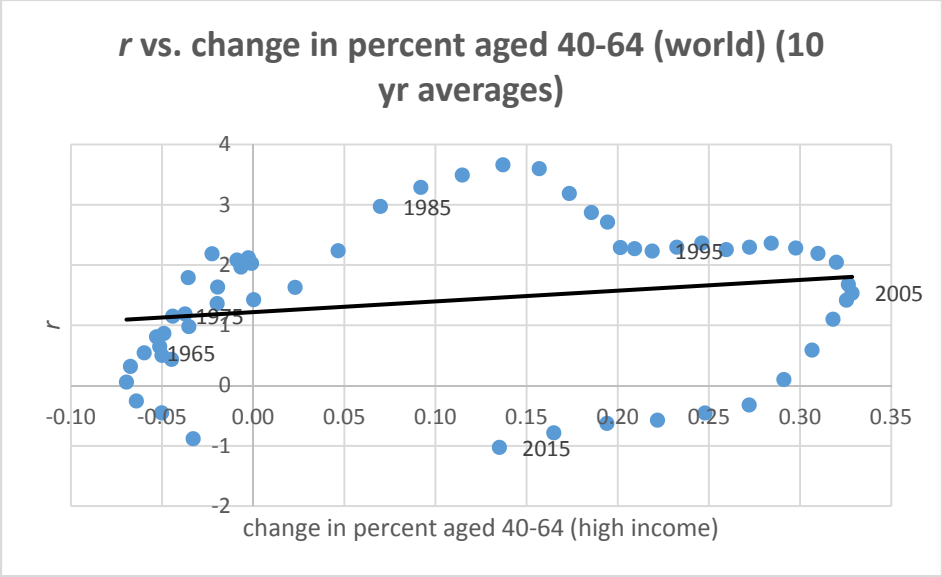

r and world percent aged 40-64 (high income) (lowpass filter)
Real Rate (Left scale)
high income percent aged 40-64 (Right scale)

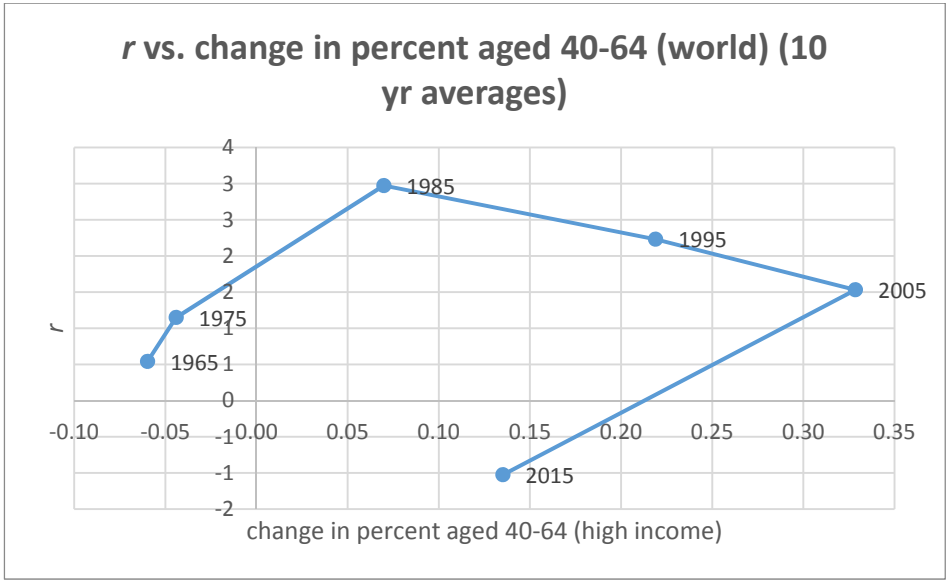

r vs. change in percent aged 40-64 (10 yr averages)
r
change in percent aged 40-64
1906
1986
1916
1996
1936
2006
1976
1966
1956
1946
1926

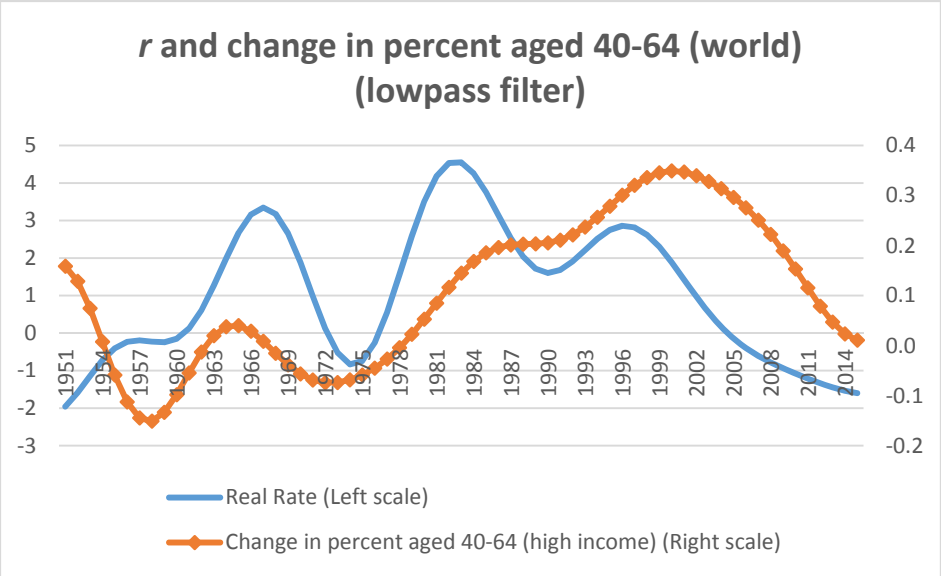

r vs. change in percent aged 40-64 (10 yr averages)
r
change in percent aged 40-64
1906
1986
1916
1996
1936
2006
1976
1966
2016
1946
1926
1956

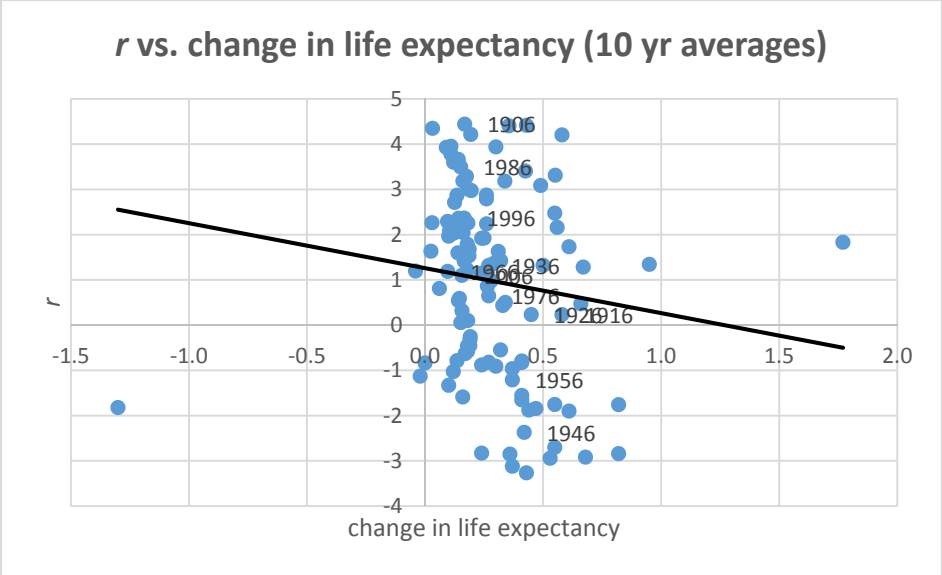

r and change in percent aged 40-64 (lowpass filter)
Real Rate (Left scale)
Change in percent aged 40-64 (Right scale)

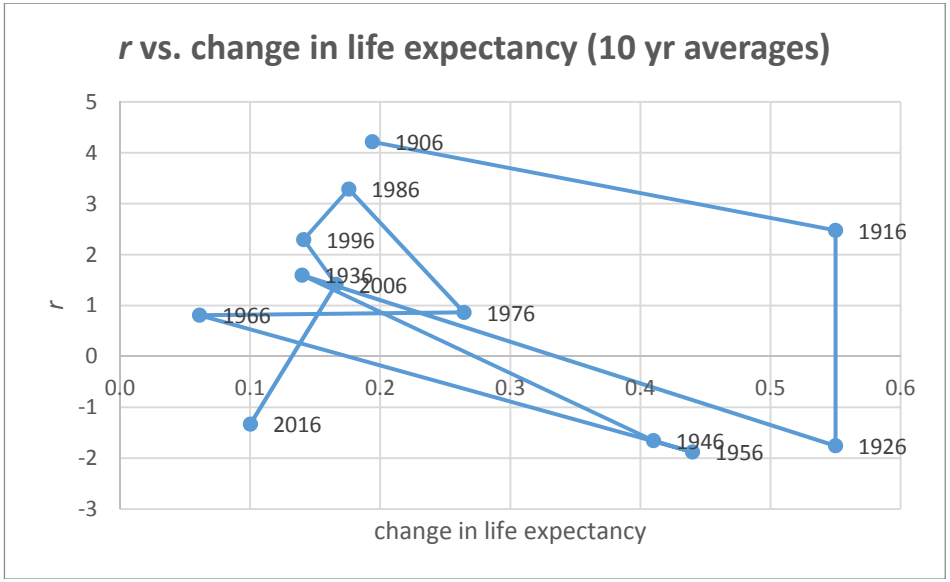

r and change in percent aged 40-64 (lowpass filter)
Real Rate (Left scale)
Change in percent aged 40-64 (Right scale)

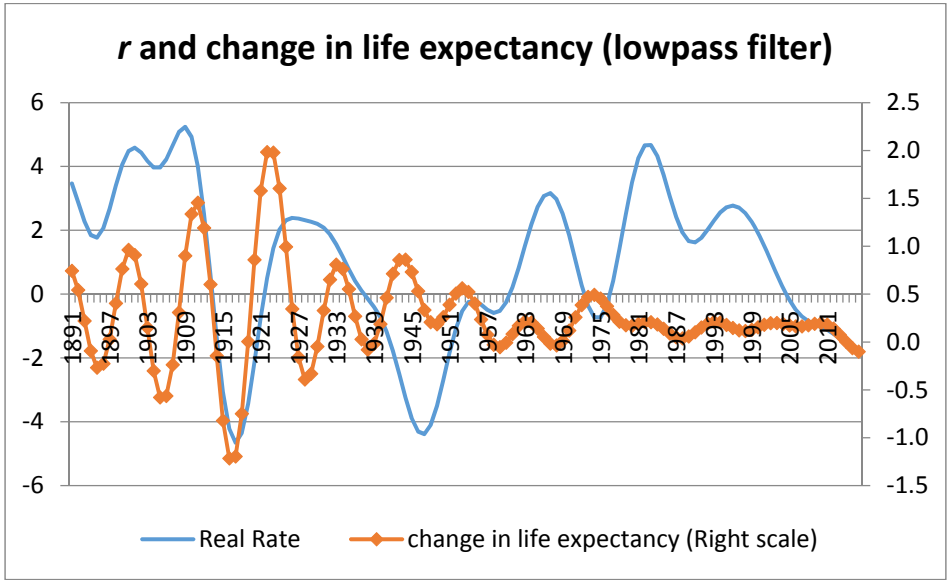

r vs. change in percent aged 40-64 (world) (10 yr averages)
r
change in percent aged 40-64 (high income)
1965
1975
1985
1995
2005
2015

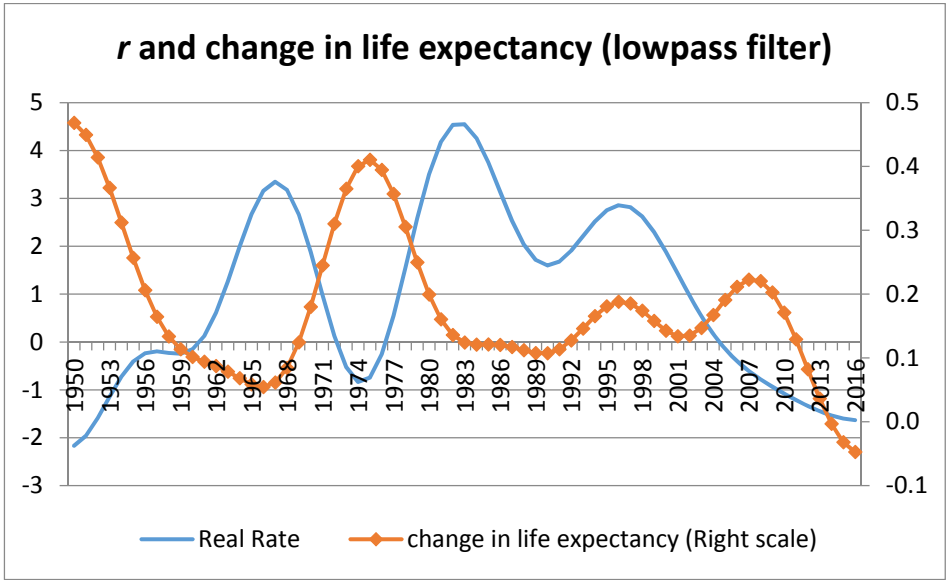

r vs. change in percent aged 40-64 (world) (10 yr averages)
r
change in percent aged 40-64 (high income)
1965
1975
1985
1995
2005
2015

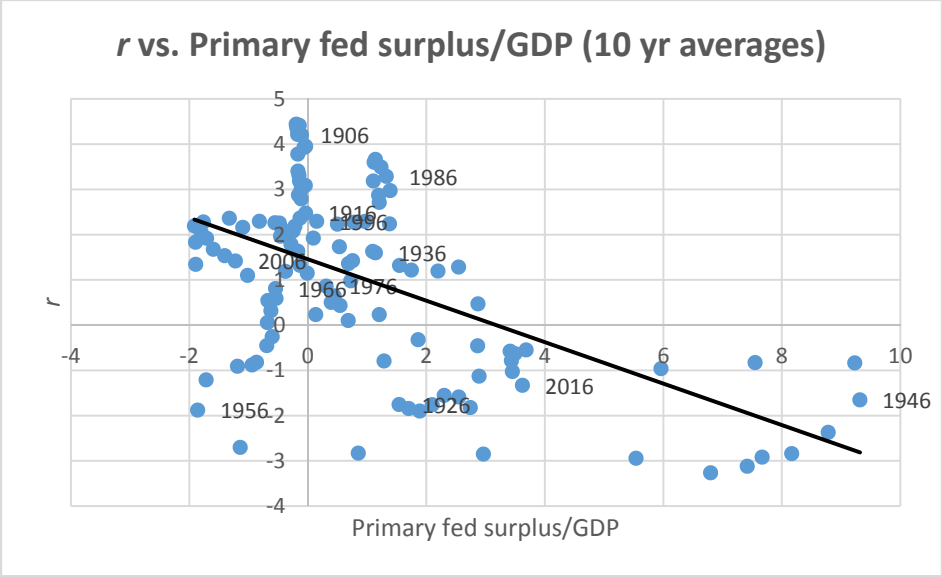

r and change in percent aged 40-64 (world) (lowpass filter)
Real Rate (Left scale)
Change in percent aged 40-64 (high income) (Right scale)

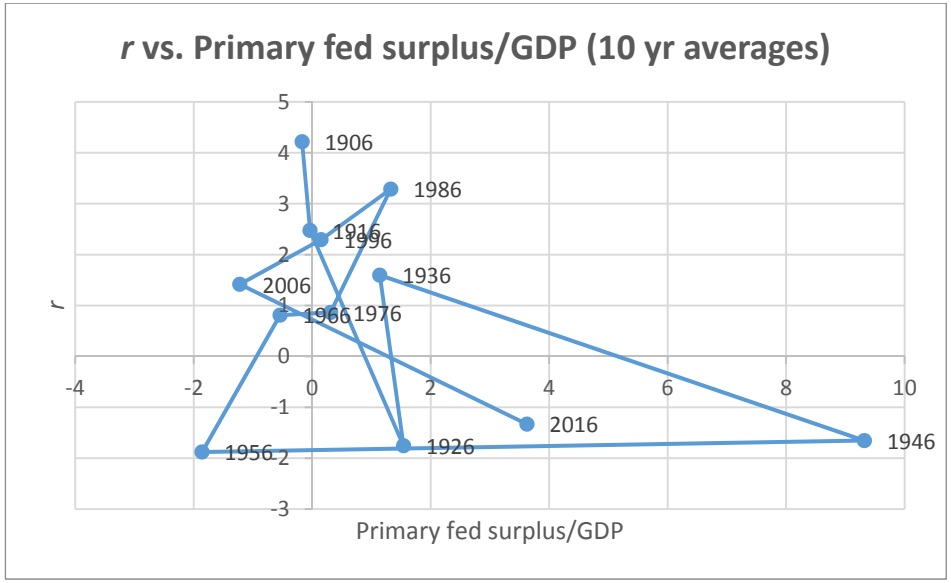

r vs. change in life expectancy (10 yr averages)
r
change in life expectancy
1906
1986
1996
1936
1976
1916
1956
1946

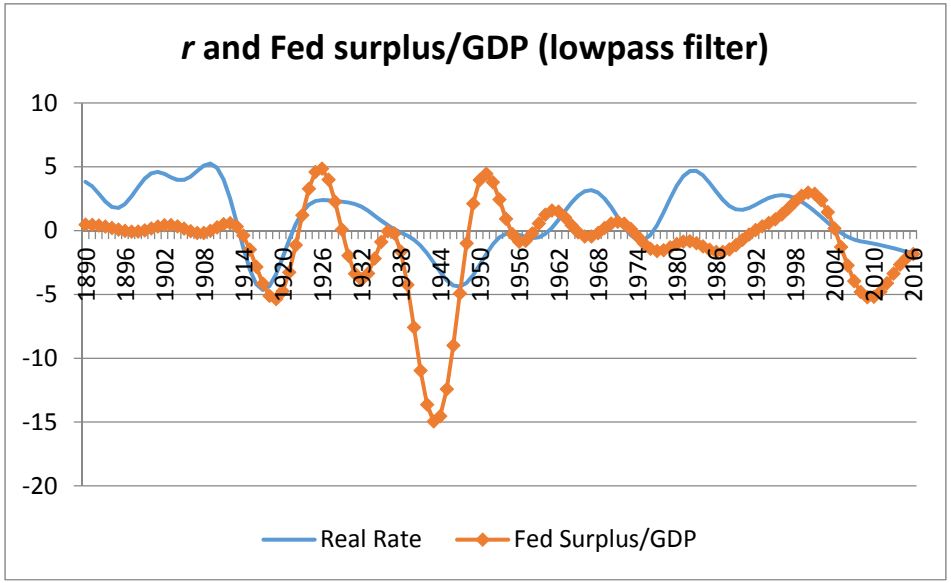

r vs. change in life expectancy (10 yr averages)
r
change in life expectancy
1906
1986
1996
1936
2006
1916
1966
1976
2016
1946
1956
1926

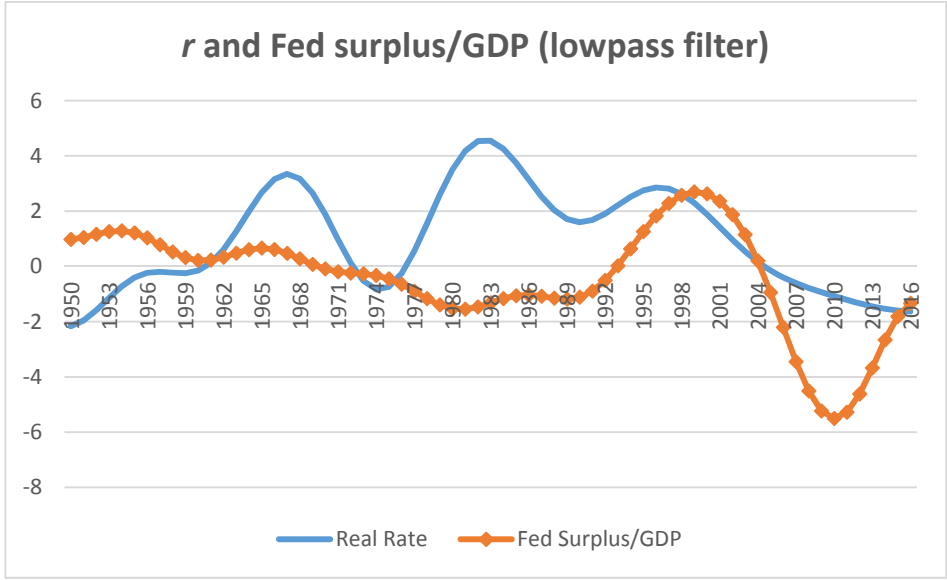

r and change in life expectancy (lowpass filter)
Real Rate
change in life expectancy (Right scale)

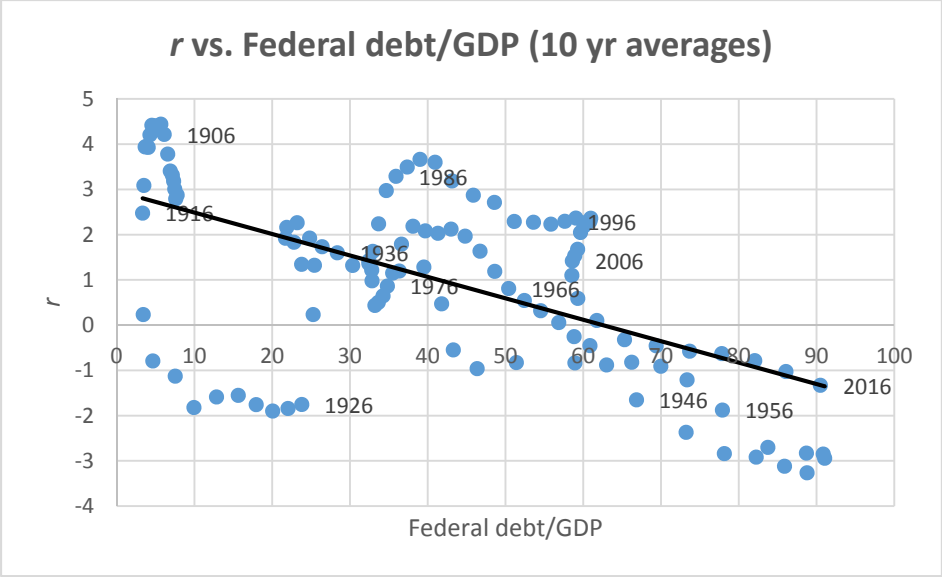

r and change in life expectancy (lowpass filter)
Real Rate
change in life expectancy (Right scale)

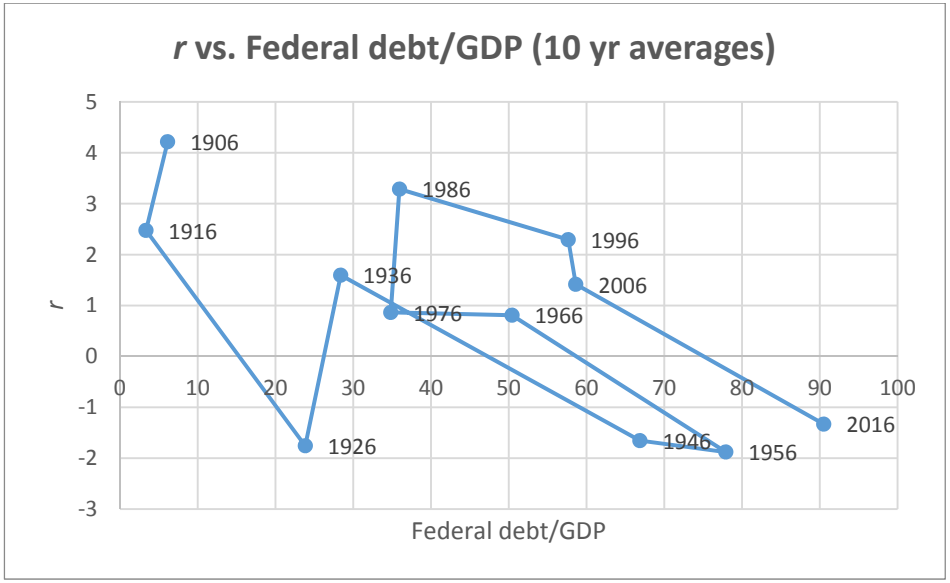

r vs. Primary fed surplus/GDP (10 yr averages)
r
Primary fed surplus/GDP
1906
1986
1916
1996
1936
2006
1966
1976
2016
1956
1926
1946

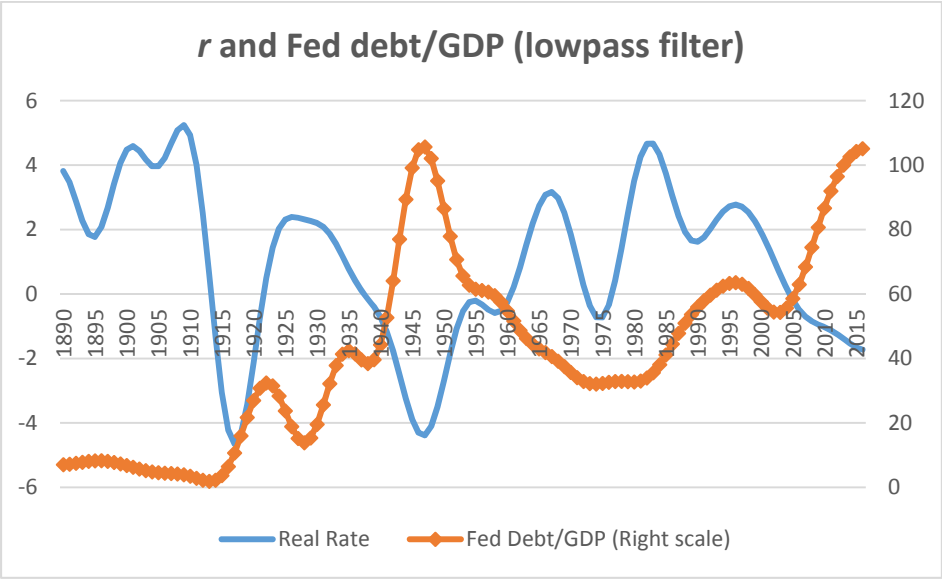

r vs. Primary fed surplus/GDP (10 yr averages)
r
Primary fed surplus/GDP
1906
1986
1916
1996
1936
2006
1966
1976
2016
1956
1926
1946

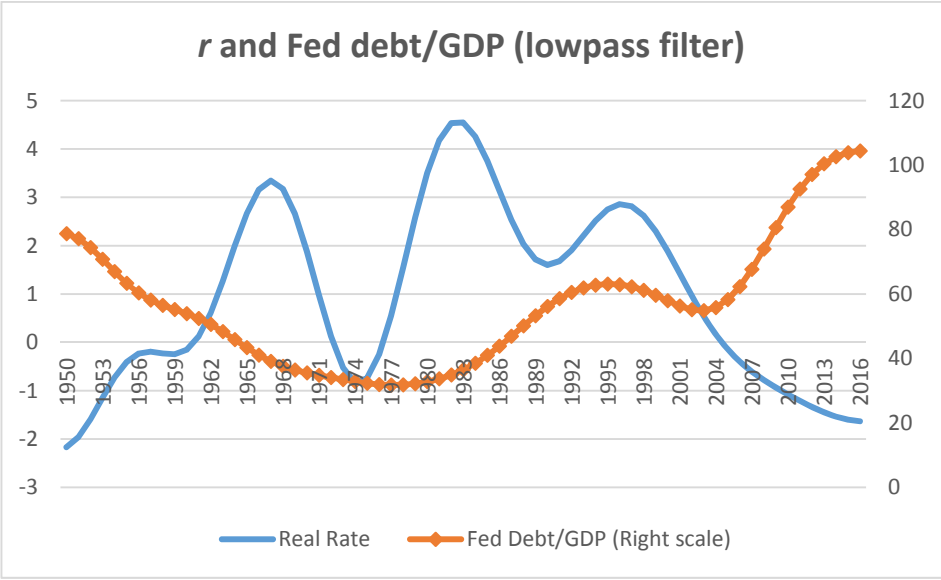

r and Fed surplus/GDP (lowpass filter)
Real Rate
Fed Surplus/GDP

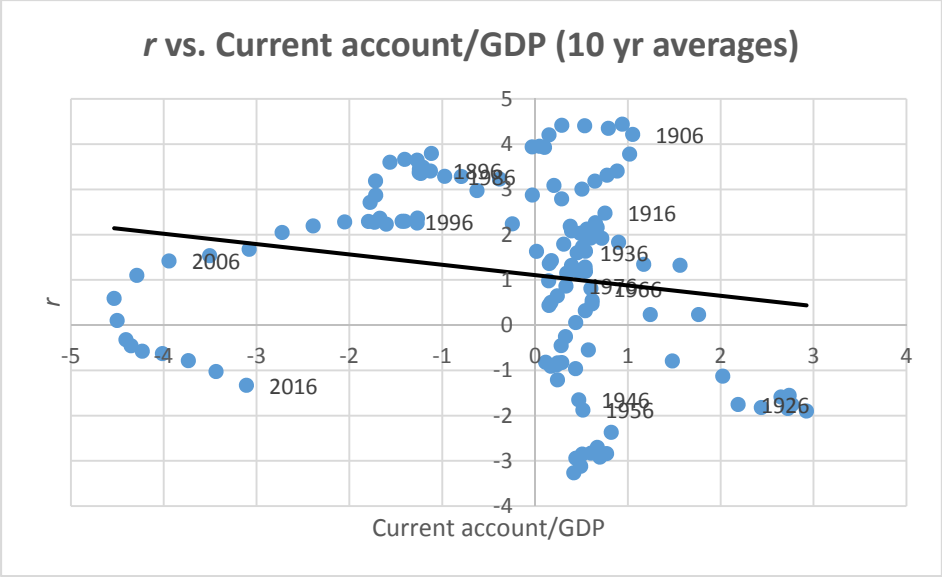

r and Fed surplus/GDP (lowpass filter)
Real Rate
Fed Surplus/GDP

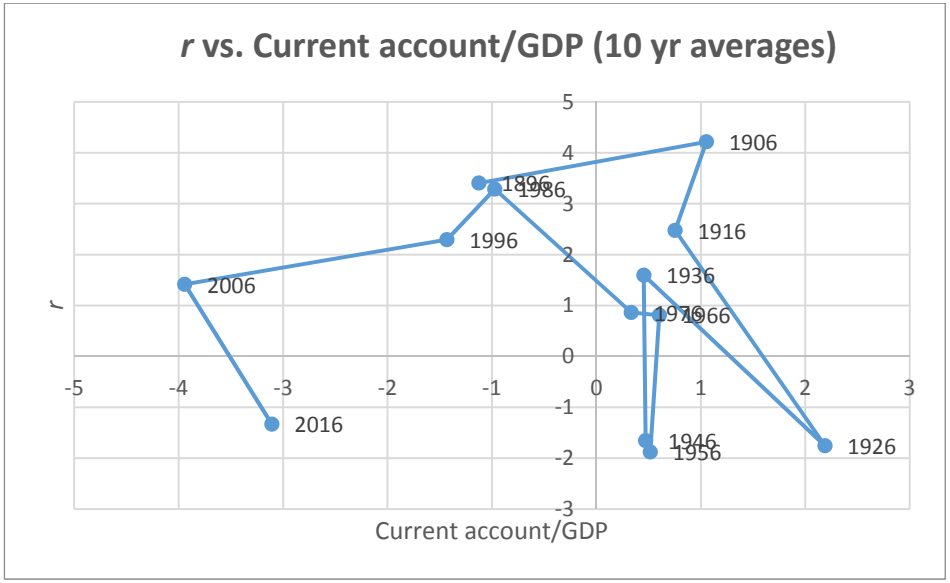

r vs. Federal debt/GDP (10 yr averages)
r
Federal debt/GDP
1906
1916
1926
1936
1946
1956
1966
1976
1986
1996
2006
2016

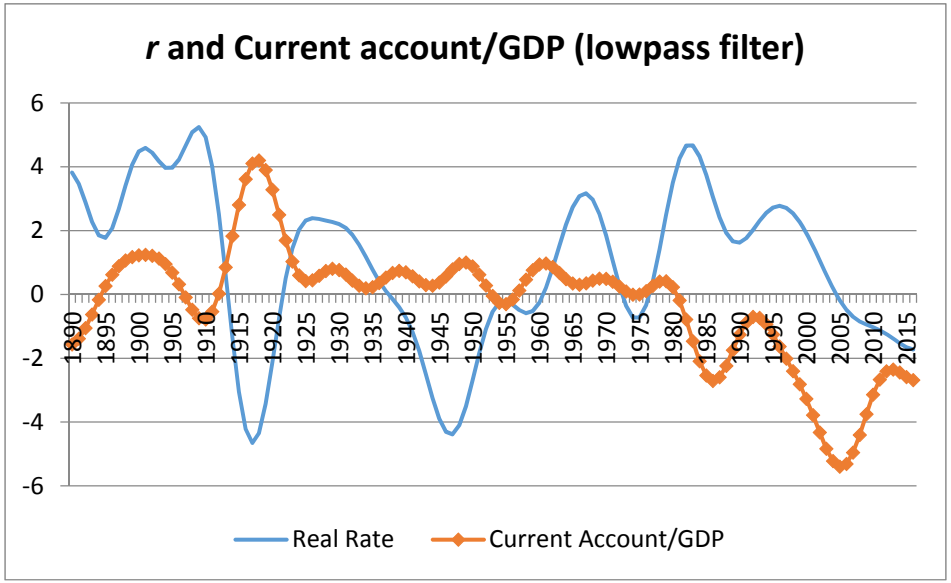

r vs. Federal debt/GDP (10 yr averages)
r
Federal debt/GDP
1906
1916
1926
1936
1946
1956
1966
1976
1986
1996
2006
2016

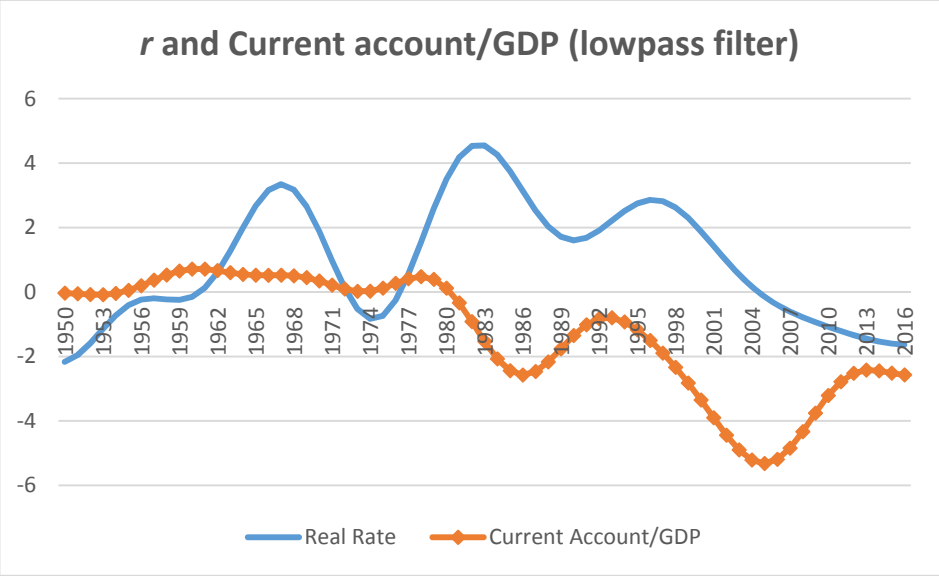

r and Fed debt/GDP (lowpass filter)
Real Rate
Fed Debt/GDP (Right scale)

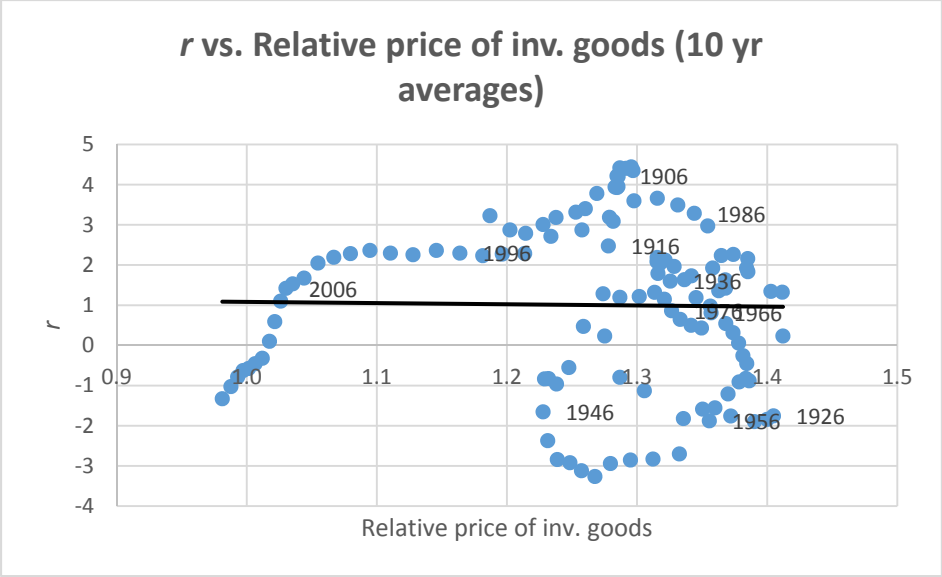

r and Fed debt/GDP (lowpass filter)
Real Rate
Fed Debt/GDP (Right scale)

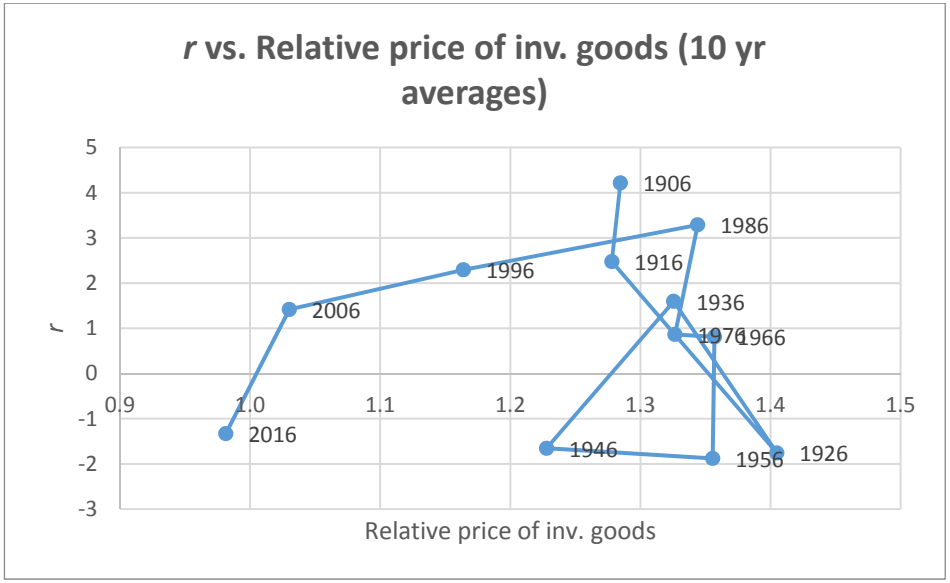

r vs. Current account/GDP (10 yr averages)
r
Current account/GDP
1906
1896
1986
1996
1916
1936
2006
1976
1966
2016
1946
1956
1926

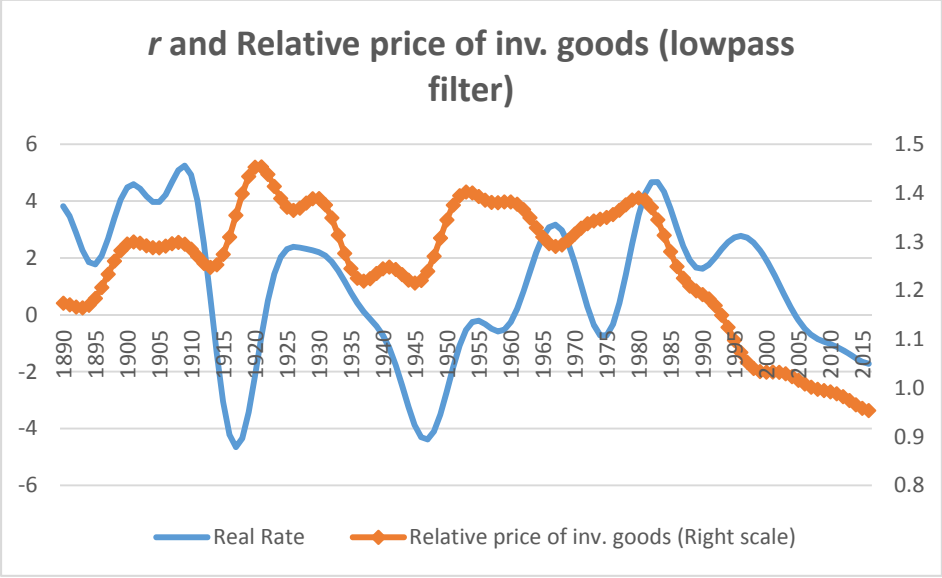

r vs. Current account/GDP (10 yr averages)
r
Current account/GDP
1906
1896
1986
1996
1916
1936
2006
1976
1966
2016
1946
1956
1926

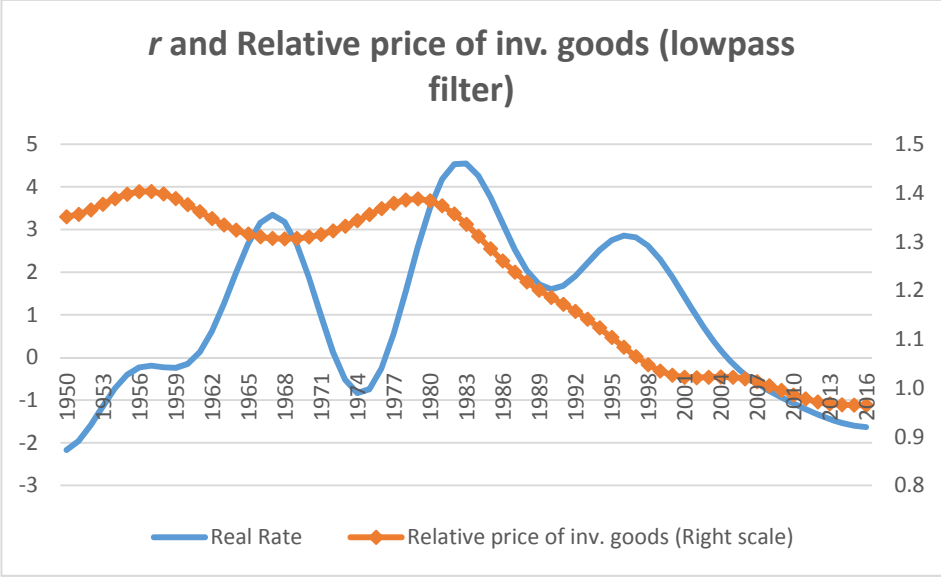

r and Current account/GDP (lowpass filter)
Real Rate
Current Account/GDP

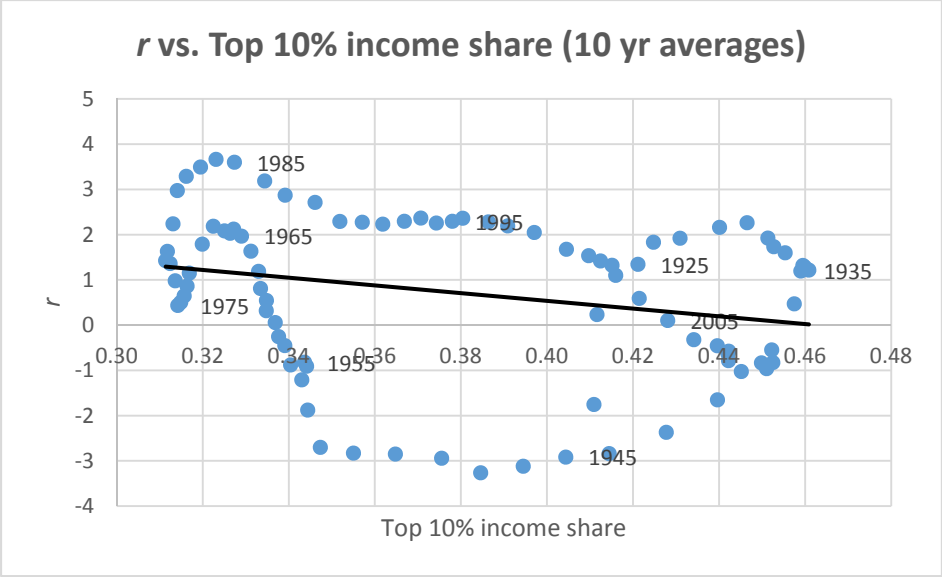

r and Current account/GDP (lowpass filter)
Real Rate
Current Account/GDP

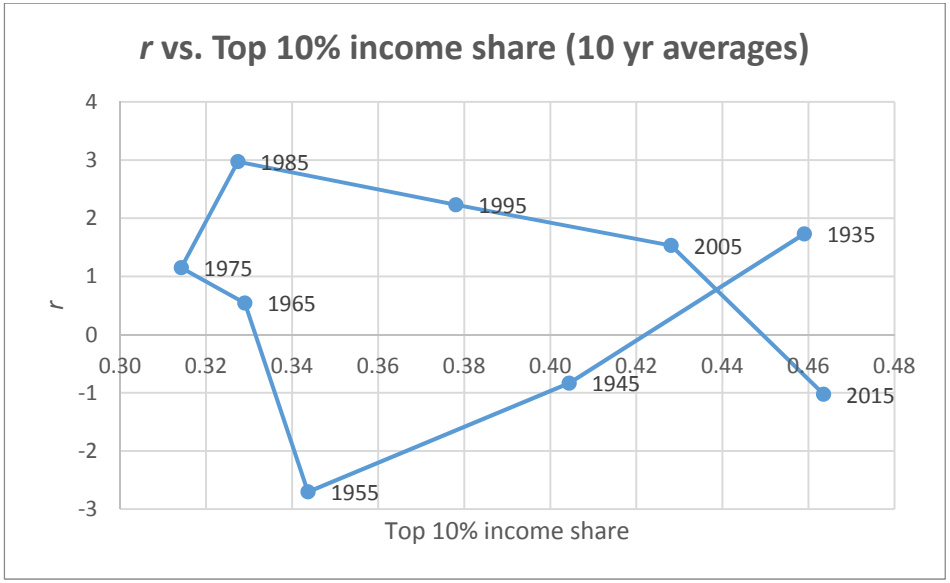

r vs. Relative price of inv. goods (10 yr averages)
r
Relative price of inv. goods
1906
1986
1916
1996
2006
1936
1976
1966
1946
1956
1926

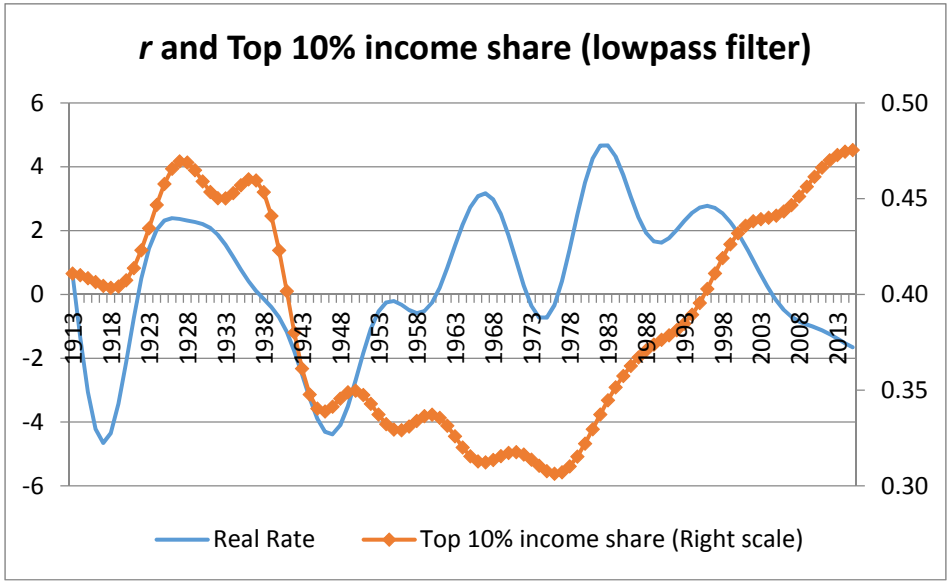

r vs. Relative price of inv. goods (10 yr averages)
r
Relative price of inv. goods
1906
1986
1916
1996
2006
1936
1976
1966
2016
1946
1956
1926

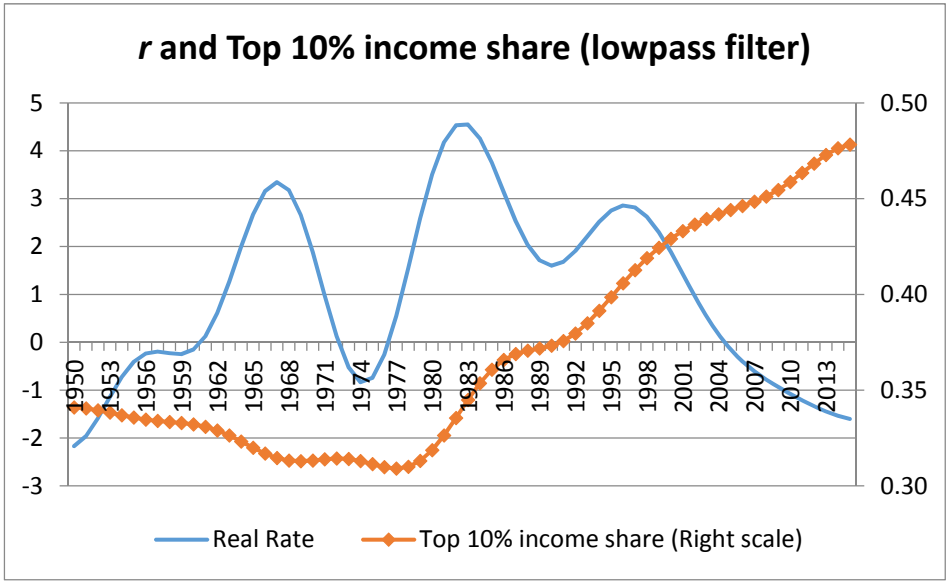

r and Relative price of inv. goods (lowpass filter)
Real Rate
Relative price of inv. goods (Right scale)

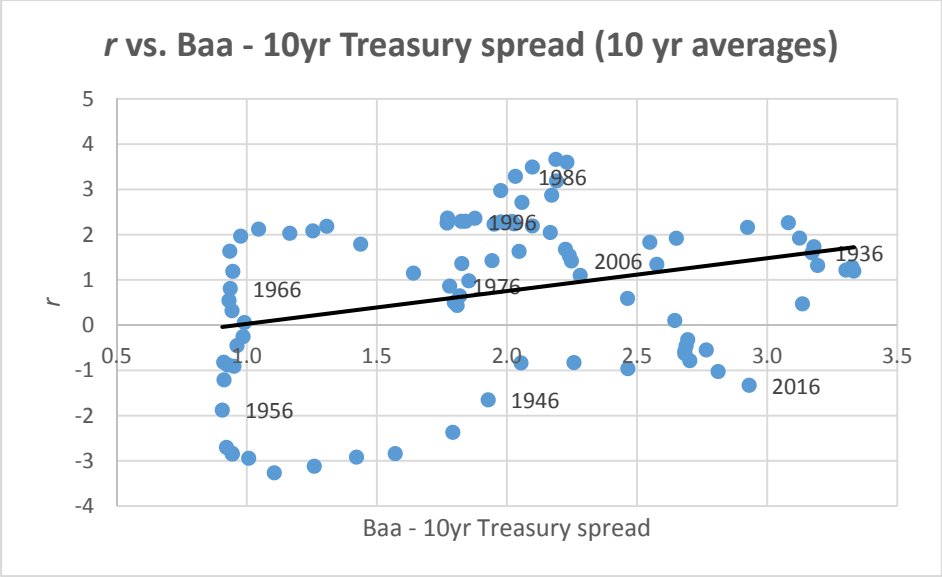

r and Relative price of inv. goods (lowpass filter)
Real Rate
Relative price of inv. goods (Right scale)

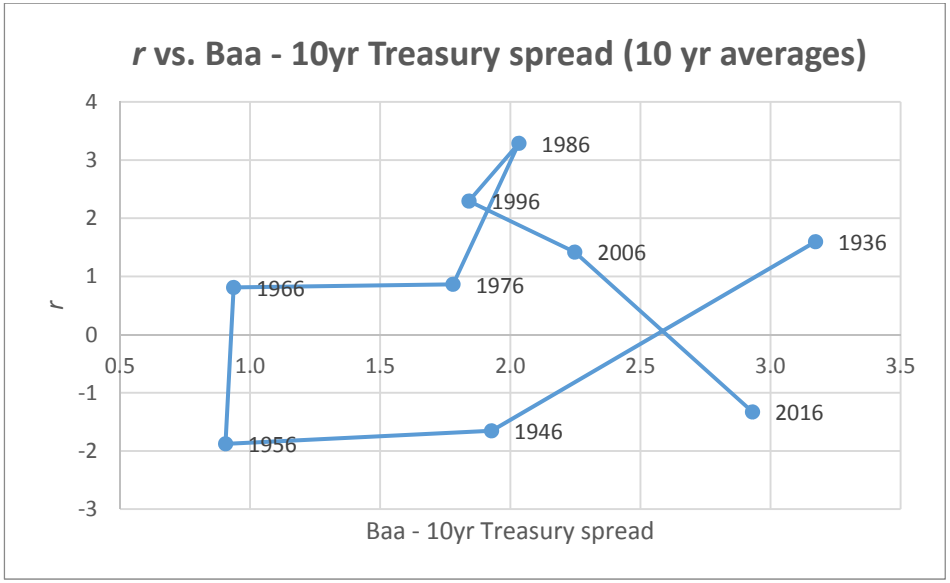

r vs. Top 10% income share (10 yr averages)
r
Top 10% income share
1985
1995
1965
1925
1935
1975
2005
1955
1945

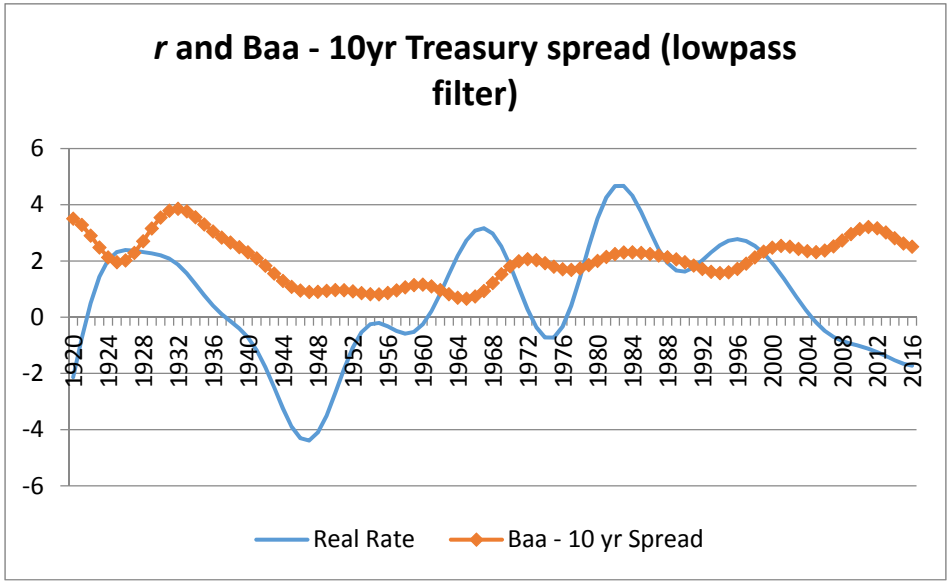

r vs. Top 10% income share (10 yr averages)
r
Top 10% income share
1985
1995
2005
1935
1975
1965
1945
1955
2015

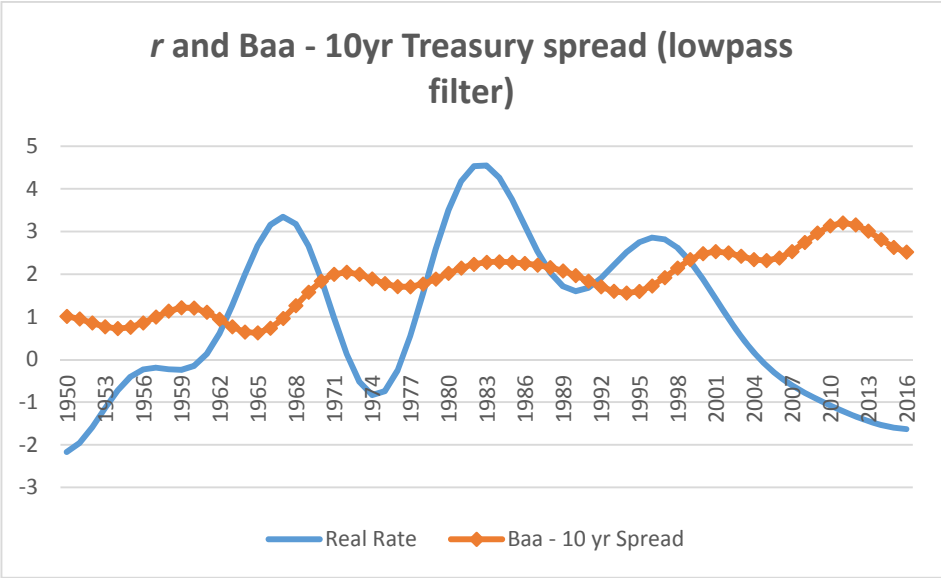

r and Top 10% income share (lowpass filter)
Real Rate
Top 10% income share (Right scale)

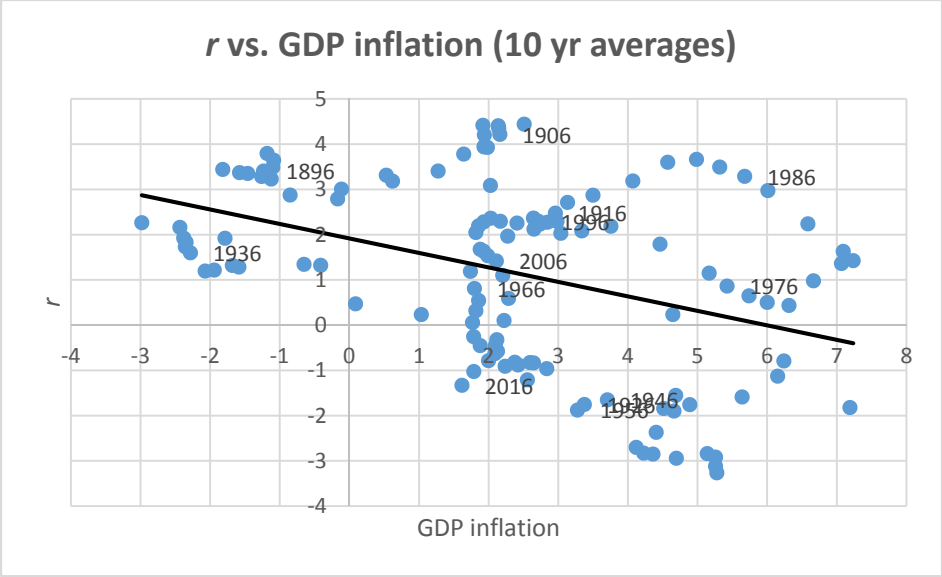

r and Top 10% income share (lowpass filter)
Real Rate
Top 10% income share (Right scale)

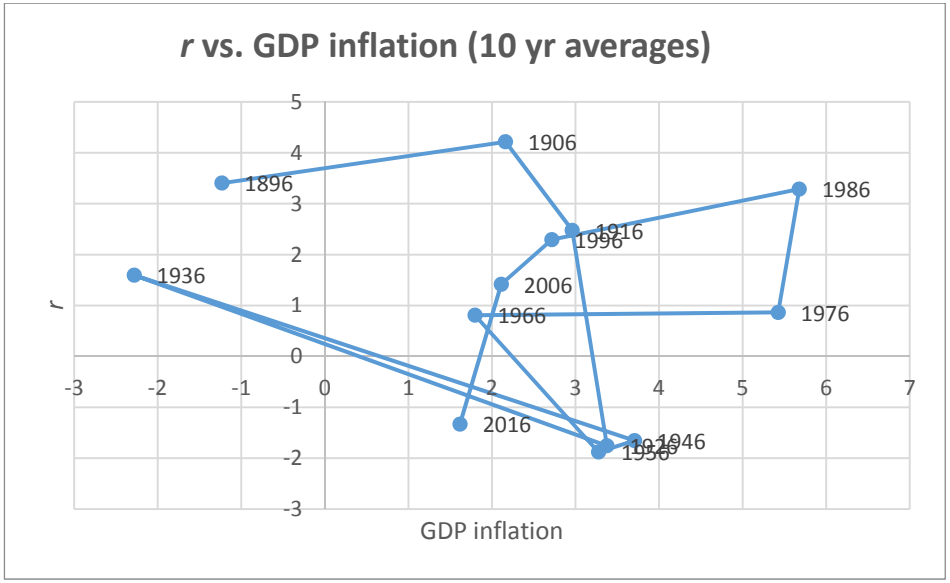

r vs. Baa - 10yr Treasury spread (10 yr averages)
r
Baa - 10yr Treasury spread
1966
1976
1986
1996
2006
1936
1956
1946
2016

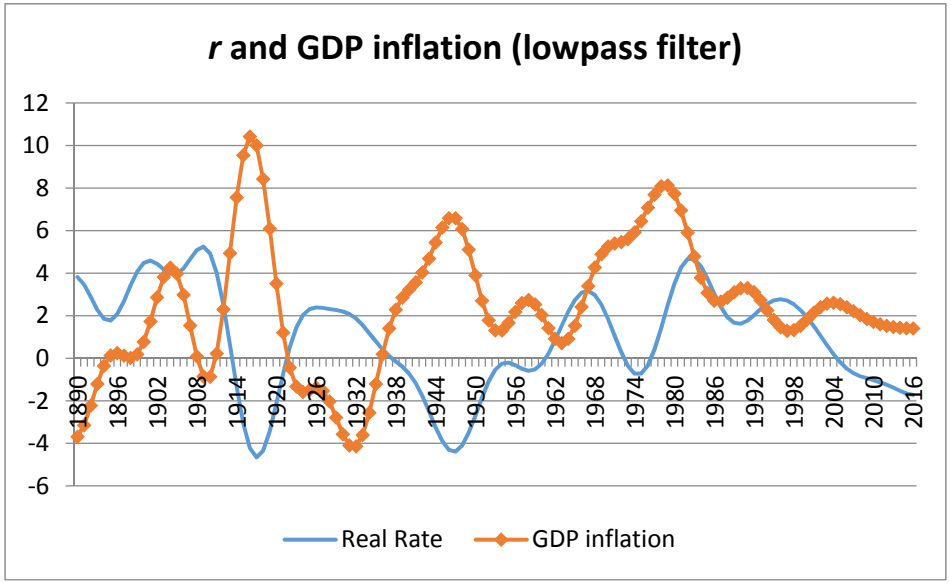

r vs. Baa - 10yr Treasury spread (10 yr averages)
r
Baa - 10yr Treasury spread
1966
1976
1986
1996
2006
1936
1956
1946
2016

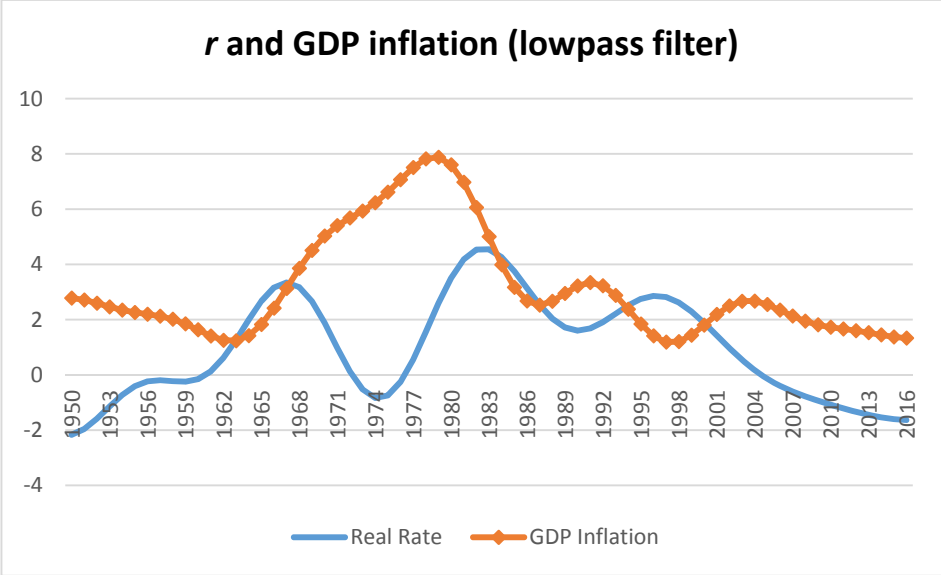

r and Baa - 10yr Treasury spread (lowpass filter)
Real Rate
Baa - 10 yr Spread

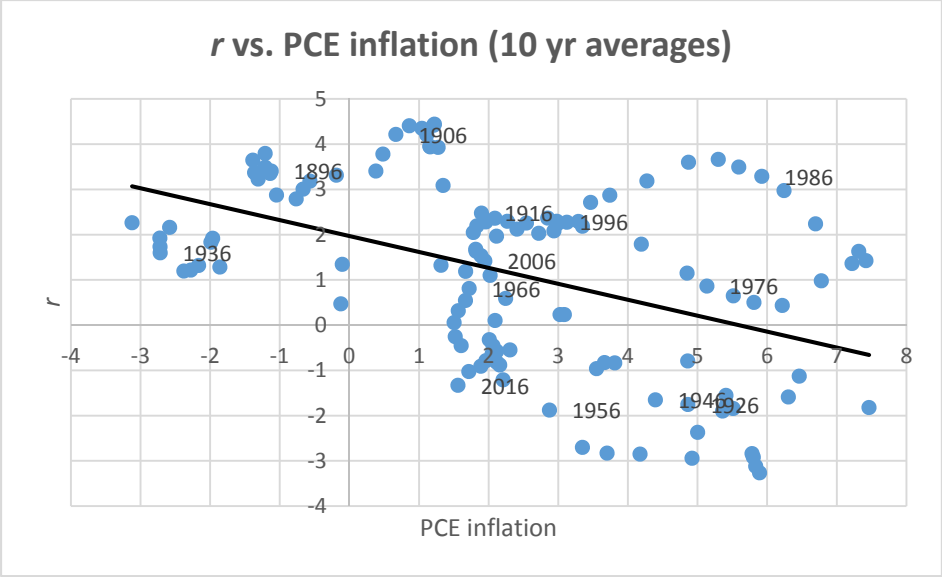

r and Baa - 10yr Treasury spread (lowpass filter)
Real Rate
Baa - 10 yr Spread

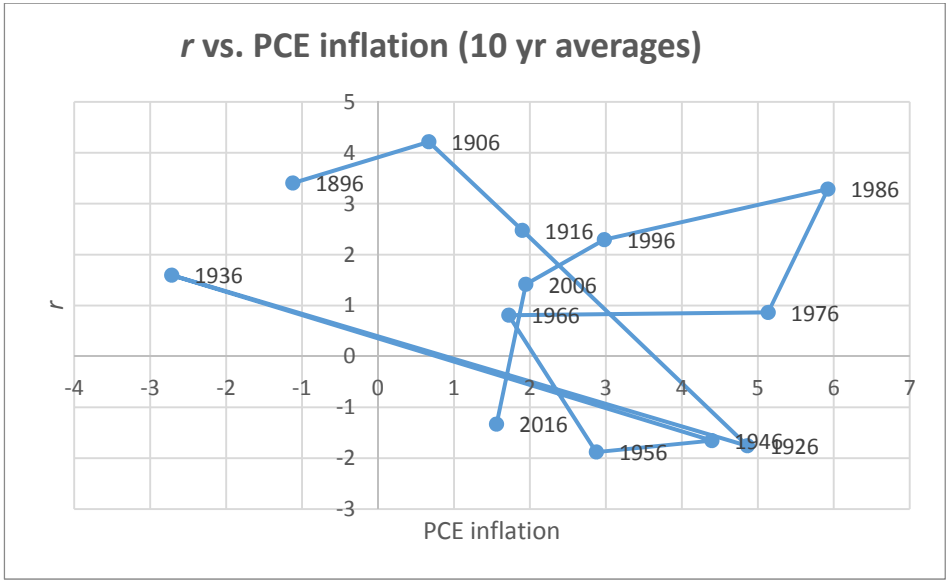

r vs. GDP inflation (10 yr averages)
r
GDP inflation
1906
1896
1986
1916
1936
2006
1966
1976
2016
1946

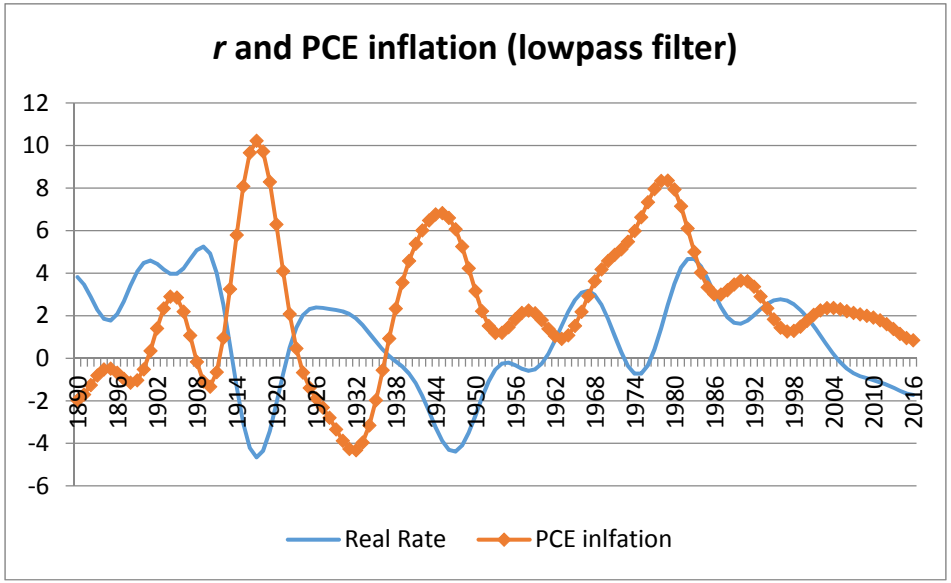

r vs. GDP inflation (10 yr averages)
r
GDP inflation
1906
1896
1986
1916
1936
2006
1966
1976
2016
1946

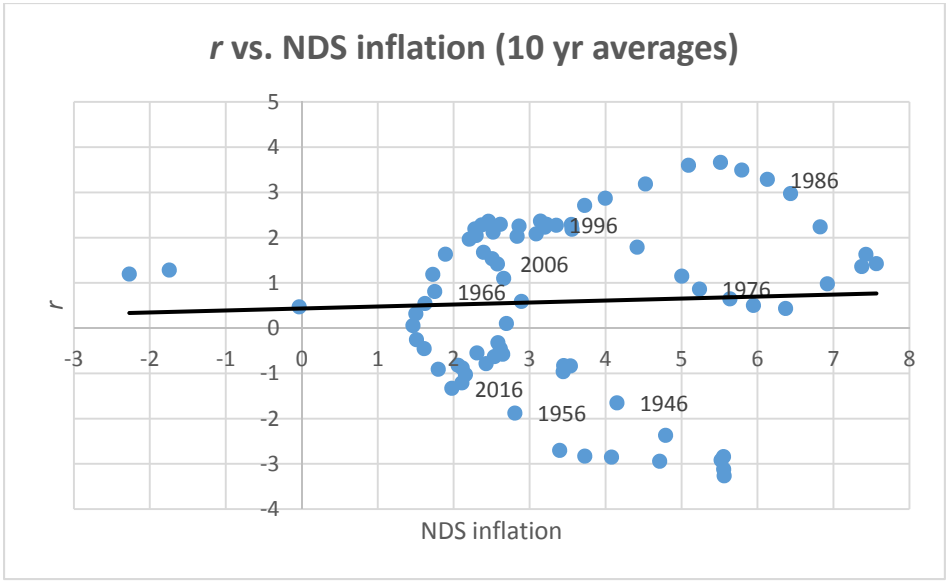

r and GDP inflation (lowpass filter)
Real Rate
GDP inflation

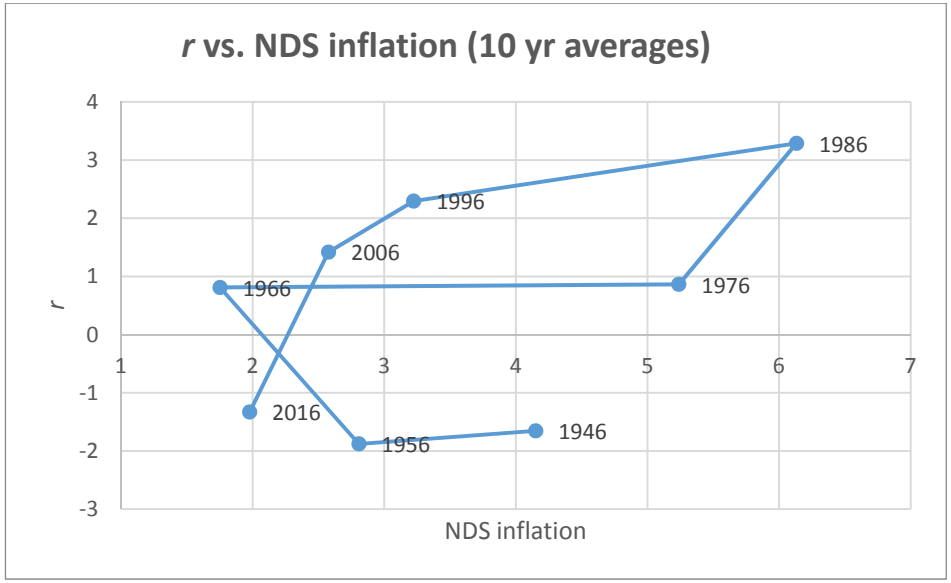

r and GDP inflation (lowpass filter)
Real Rate
GDP Inflation

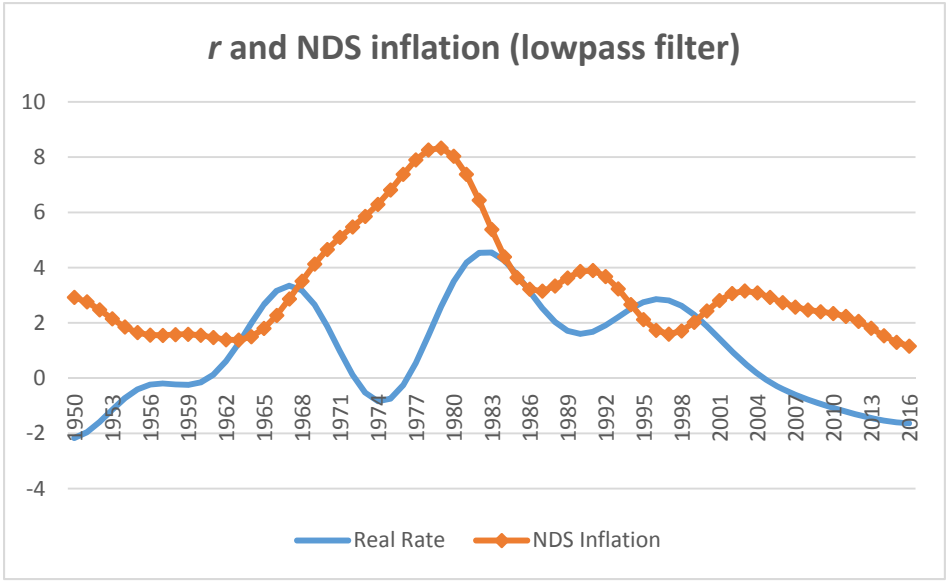

r vs. PCE inflation (10 yr averages)
r
PCE inflation
1906
1896
1986
1916
1996
1936
2006
1966
1976
2016
1956
1946
1926

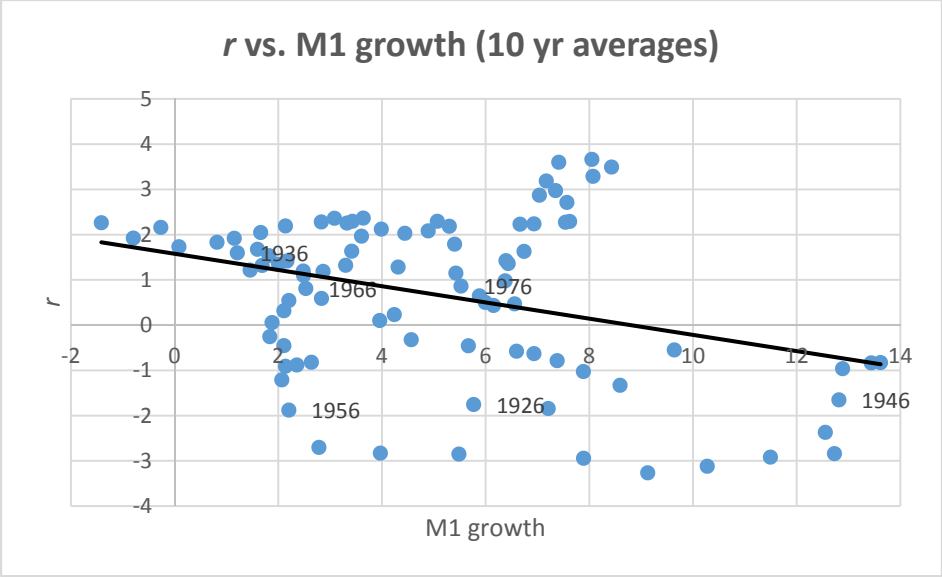

r vs. PCE inflation (10 yr averages)
r
PCE inflation
1906
1896
1986
1916
1996
1936
2006
1966
1976
2016
1956
1946
1926

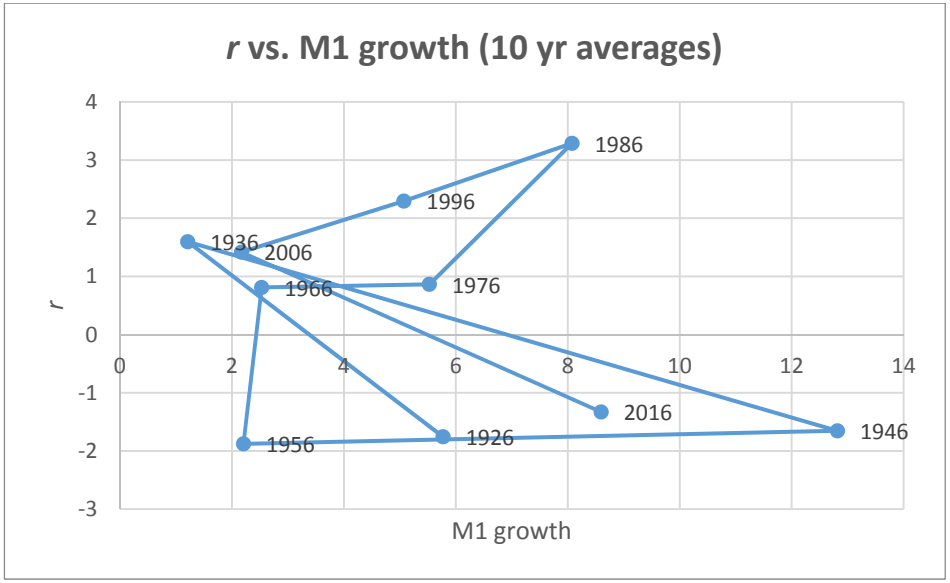

r and PCE inflation (lowpass filter)
Real Rate
PCE inlfation

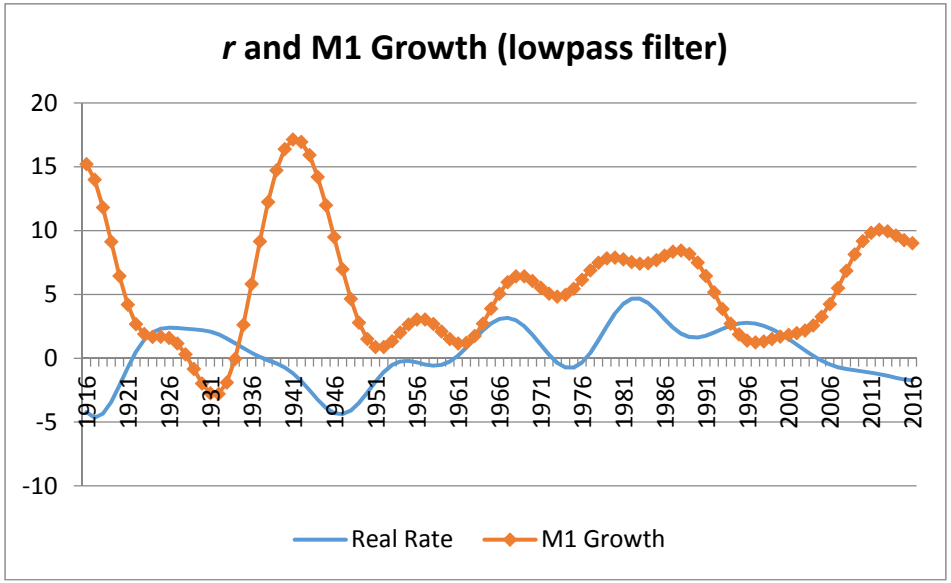

r vs. NDS inflation (10 yr averages)
r
NDS inflation
1986
1996
2006
1966
1976
2016
1956
1946

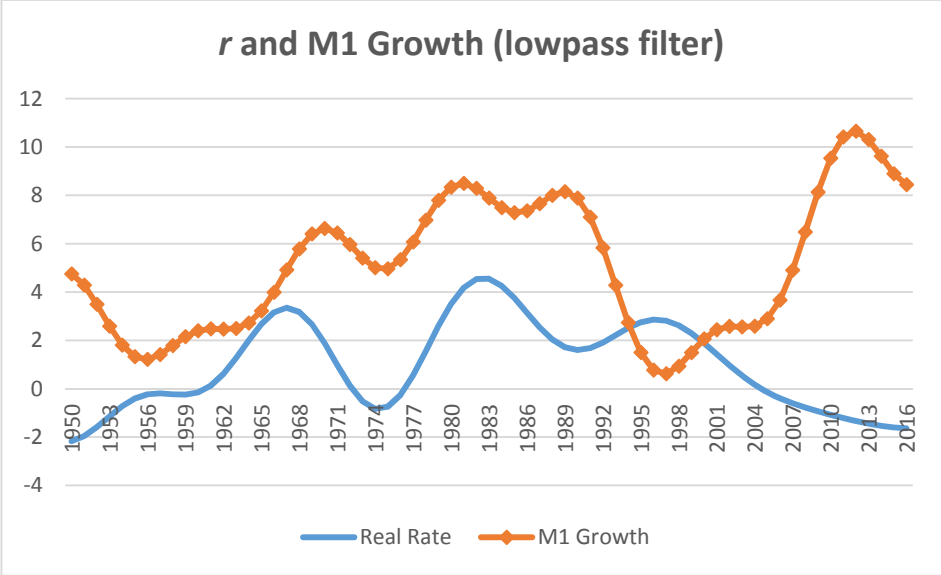

r vs. NDS inflation (10 yr averages)
r
NDS inflation
1986
1996
2006
1966
1976
2016
1956
1946

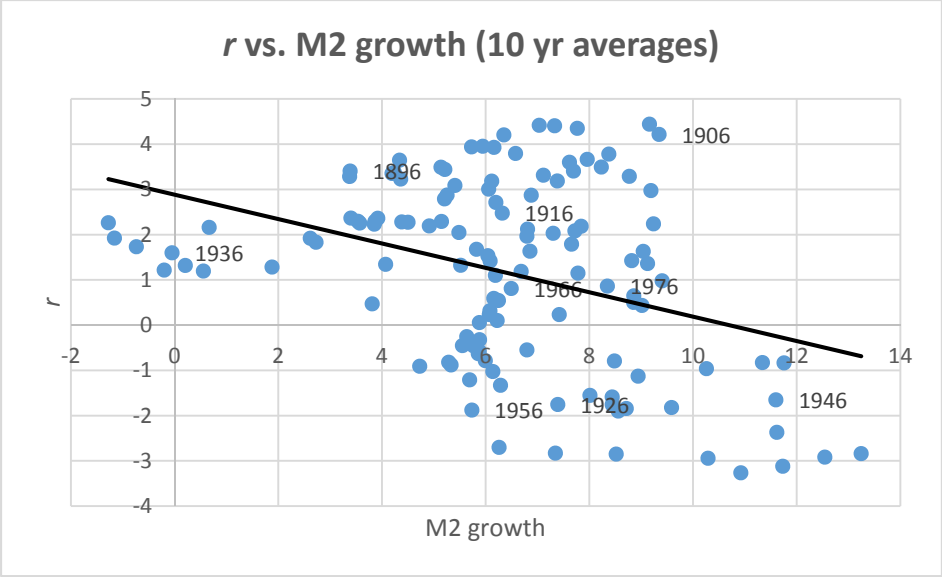

r and NDS inflation (lowpass filter)
Real Rate
NDS Inflation

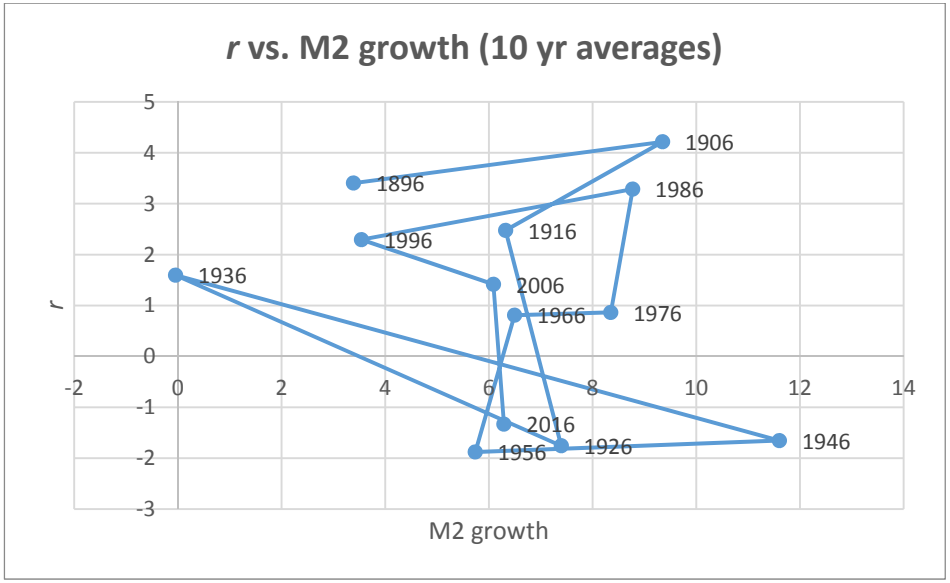

r vs. M1 growth (10 yr averages)
r
M1 growth
1936
1966
1976
1956
1926
1946

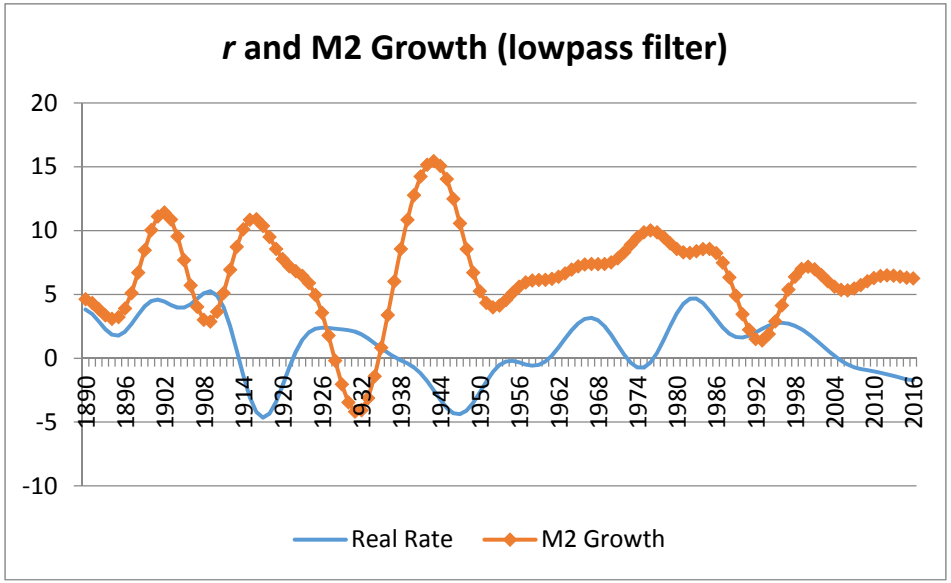

r vs. M1 growth (10 yr averages)
r
M1 growth
1986
1996
1936
2006
1966
1976
2016
1946
1956
1926

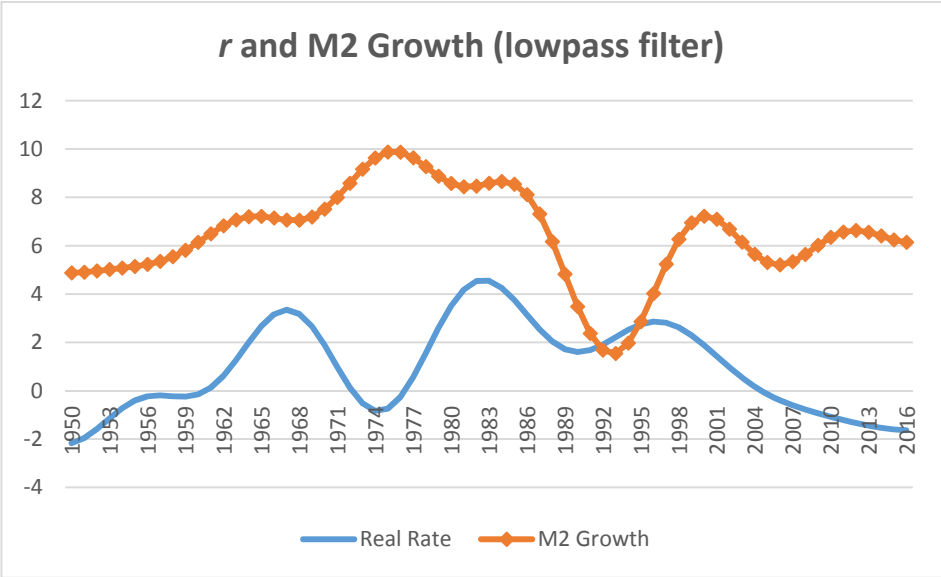

r and M1 Growth (lowpass filter)
Real Rate
M1 Growth


r and M1 Growth (lowpass filter)
Real Rate
M1 Growth


r vs. M2 growth (10 yr averages)
r
M2 growth
1906
1896
1916
1936
1966
1976
1956
1926
1946


r vs. M2 growth (10 yr averages)
r
M2 growth
1906
1896
1986
1916
1996
1936
2006
1966
1976
2016
1956
1926
1946


r and M2 Growth (lowpass filter)
Real Rate
M2 Growth


r and M2 Growth (lowpass filter)
Real Rate
M2 Growth