Inflation, Debt, and Default

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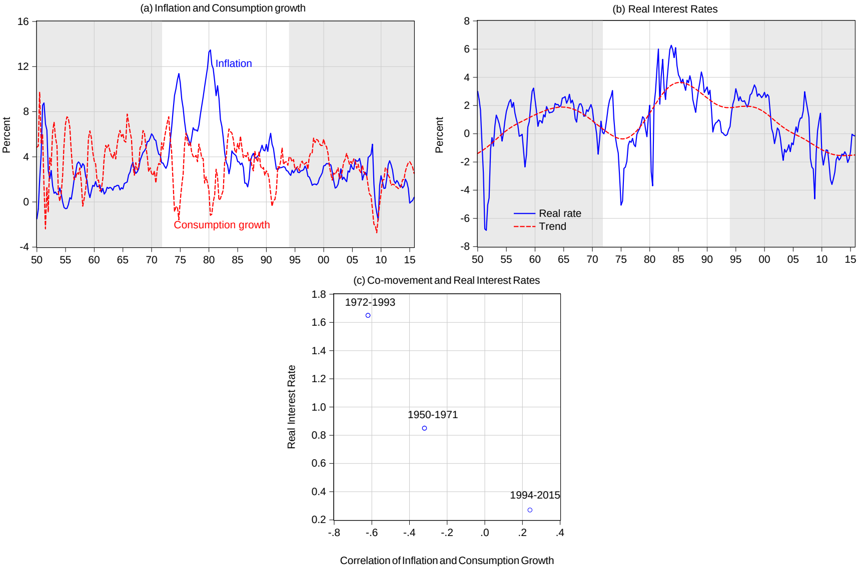
October, 2017

Motivation: U.S. inflation cyclicality discount



Note: Inflation is the log difference between CPI in quarter t and CPI in quarter t-4. Consumption growth is the log difference in real personal consumption expenditures over the same interval. Real interest rates are nominal interest rates on government securities (from the IMF IFS database) minus expected inflation computed using a linear univariate forecasting model estimated on actual inflat

Why inflation cyclicality matters

- The majority of sovereign debt in advanced economies is
  - subject to inflation risk (nominal)
  - held domestically data

- The co-movement between inflation and consumption growth varies over time and across countries

- Procyclical inflation makes nominal debt
  - less risky to lender: less inflation in bad times (hedging)
  - more risky to borrower: more payout bad times (default risk)
  - in bad times, procyclical/countercyclical inflation complements/substitutes default

This paper

- We document an inflation-procyclicality discount
  - higher covariance associated with lower real rates
  - but not so much in bad states
- Build a sovereign default model with domestic nominal debt
  - take correlation between inflation and economic activity as given (changes in monetary policy regime or type of shocks)
- In the calibrated model, the pro-cyclical economy has
  - lower real rates in normal times
  - more debt crises and defaults in bad times
- Increases in inflation cyclicality could be important for explaining fall in real rates (US ?) and increase in default crises (Euro ?)

Related literature

- Sovereign default: Eaton and Gersovitz (1981), Aguiar and Gopinath (2007), Arellano (2008), Chatterjee and Eyigungor (2012), Lizarazo (2013), Aguiar et al. (2016), and many others.
- Domestic/Selective default: Broner et al. (2010), Reinhart and Rogoff (2011), D'Erasmo and Mendoza (2012), Pouzo and Presno (2014), Mallucci (2015), Arellano and Kocherlakota (2014).
- Default and inflation: Aguiar et al. (2012), Berriel and Bhattarai (2013), Faraglia et al. (2013), Nuno and Thomas (2015), Du and Schreger (2015), Kursat, Onder and Sunel (2016), Sunder-Plassman (2016), Perez and Ottonello (2016), Fried (2017).
- Cyclicality of inflation: Boudoukh (1993), Ang et al. (2008), Campbell et al. (2016), Song (2014), Du et al. (2016), Kang and Pflueger (2015)
- Monetary unions: Aguiar et al. (2013), Corsetti and Dedola (2013)

Empirical evidence

Evidence on real yields and inflation cyclicality

- Compute country-specific time-varying co-movement between innovations to inflation and to consumption growth

- Follow Boudoukh (1993)'s country-by-country VAR

$$\begin{bmatrix} \pi_{it} \\ g^c_{it} \end{bmatrix} = A_i \begin{bmatrix} \pi_{i,t-1} \\ g^c_{i,t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{\pi it} \\ \varepsilon_{git} \end{bmatrix}$$

  - sample: 19 OECD countries; quarterly data 1985-2015
  - compute conditional co-movement between $\varepsilon_{\pi it}$ and ε_{git} using overlapping ten-year windows

Graph

- Real yields adjusted for expected future inflation

Real interest rates: the inflation cyclicality discount

	Real yield on government debt		
	(1)	(2)	(3)
Inflation consumption covariance	-1.797^{***}	-1.637^{***}	-1.804^{**}
	(0.539)	(0.380)	(0.636)
Lagged Debt	Yes	Yes	Yes
Mean of π and g_c residuals	No	Yes	Yes
Variance of π and g_c residuals	No	No	Yes
adj. R^2	0.881	0.902	0.903
N	1726	1726	1726

Countries: AUS,AUT,BEL,CAN,CHE,DEU,DNK,ESP,FIN,FRA,GBR,
ITA,JPN,KOR,NLD,NOR,PRT,SWE,USA.
Standard errors clustered by country. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All regressions include country and time fixed effects

- One standard deviation increase in $\text{cov}(\varepsilon_{it}^{\pi}, \varepsilon_{it}^{g_c}) \sim 0.17$ is associated with $\sim$ 31 bp decrease in real sovereign yields

Procyclicality discount only in good times

	Real yield on government debt		
	(1)	(2)	(3)
Inflation consumption covariance	-1.804^{**}	-1.159	
	(0.636)	(0.683)	
Covariance*$\mathbf{1}_{\text{good times}}$		-1.834^{***}	-2.994^{***}
		(0.506)	(0.696)
Covariance*$\mathbf{1}_{\text{bad times}}$			-1.159
			(0.683)
$\mathbf{1}_{\text{good times}}$	Yes	Yes	Yes
other controls	Yes	Yes	Yes
adj. R^2	0.903	0.910	0.910
N	1726	1726	1726

$\mathbf{1}_{\text{good times}} \equiv$ average residual cons. growth > 0. alternative specification: default prob.
Countries: AUS,AUT,BEL,CAN,CHE,DEU,DNK,ESP,FIN,FRA,GBR, ITA,JPN,KOR,NLD,NOR,PRT,SWE,USA.
Standard errors clustered by country. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All regressions include country and time fixed effects.

Model

- We develop a model of sovereign debt
  - builds on standard model
  - inflation, exogenous
    (e.g. changes in monetary independence,
    changes in nature of supply/demand shocks in the economy)
  - risk-averse, domestic lenders hold nominal bonds
- Simple 2 period model to develop intuition
- Calibrated model to investigate how inflation cyclicality affects interest rates, dynamics of debt and default

A two period model

- Competitive lenders (patient) and borrowers (less patient) with endowments
  - First period: $y_\ell = y_b = 1$
  - Second period: $y_\ell = y_b = x$
  - $x \sim F(x), E(x) = 1$, Finite support, $x \in [x_{min}, x_{max}]$
  - x aggregate risk, both agents exposed to it
- Debt b is nominal with price q and nominal payoff of 1
- Price level in period 1 normalized to 1
- Cyclical prices (inflation) in period 2: $\pi(x) = (1 + \kappa(x - 1))$
  - κ: cyclicality of inflation
  - if $\kappa > 0$, $\Rightarrow$ high inflation in good times
  - Expected inflation is 0, hence $1/q$ is real interest rate

No default case

- Borrower solves

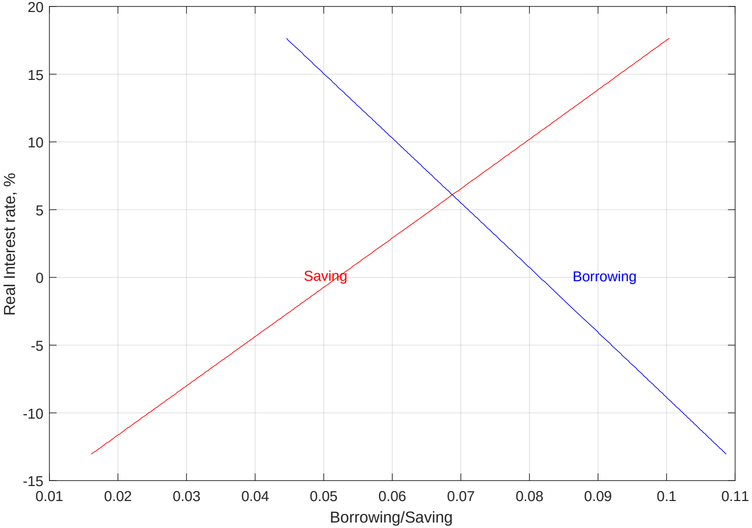
$$\max_b u(1 - qb_b) + \beta_b \int_X u\left(x + \frac{b_b}{\pi(x;\kappa)}\right) dF(x),$$

- Lender solves

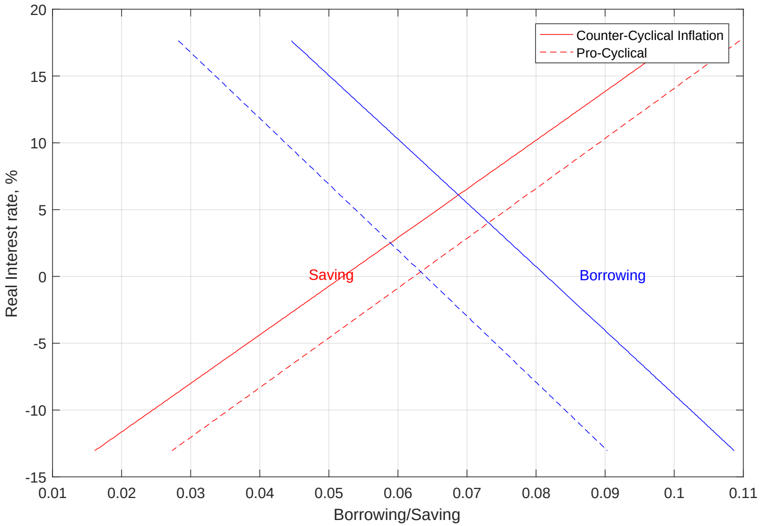
$$\max_b u(1 - qb_\ell) + \beta_\ell \int_X u\left(x + \frac{b_\ell}{\pi(x;\kappa)}\right) dF(x),$$

- Equilibrium: b_ℓ, b_b, q s.t., given q, b_ℓ, b_b are optimal, and $b_\ell = -b_b$

Interest rates and cyclicality of inflation



Interest rates and cyclicality of inflation



Interest rates and cyclicality of inflation

As inflation moves from countercyclical to procyclical:

- Lenders want to save more (better hedging with bonds)
- Borrowers want to borrow less (worse hedging with bonds)
- Real Interest rate unequivocally falls
- Equilibrium intermediation can move in either direction

Simple model with default

- Borrower can default by paying a cost $C(x) = \psi(x - x_{\min})^2$
- Equilibrium default when costs are below repayment
- Default set (typically is an interval)

$$x : \psi(x - x_{\min})^2 < \frac{-b}{\pi(x;\kappa)}$$

- Competitive default model (see Geanakoplos et al., 2005), i.e. borrowers are atomistic, so do not internalize the effect of their own borrowing on spreads
- With default, cyclicality of inflation can change the default sets, thereby altering the hedging properties of bonds

Simple model with default

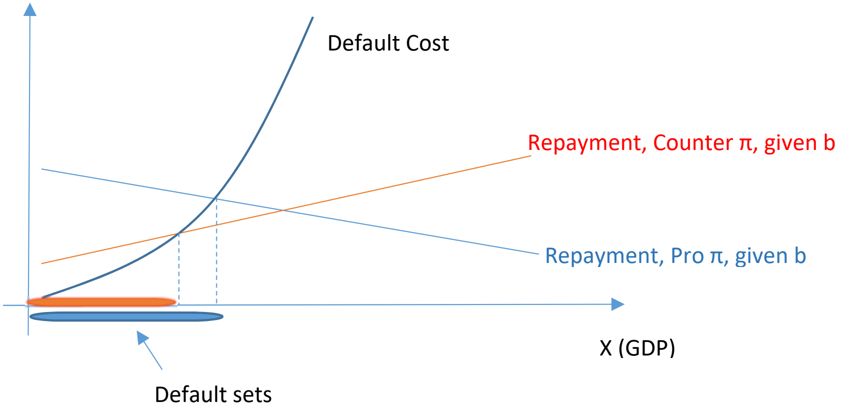
- Borrower solves

$$\max_{b_b} u\left(1-qb_b\right)+\beta_b\left(\underbrace{\int_{\widehat{x(b)}}^{x_{\max}} u\left(x+\frac{b_b}{\pi(x)}\right)}_{\text{Repayment}}+\underbrace{\int_{x_{\min}}^{\widehat{x(b)}} u\left(x-C(x)\right)}_{\text{Default and suffer cost}}\right)\mathrm{d}F\left(x\right)$$

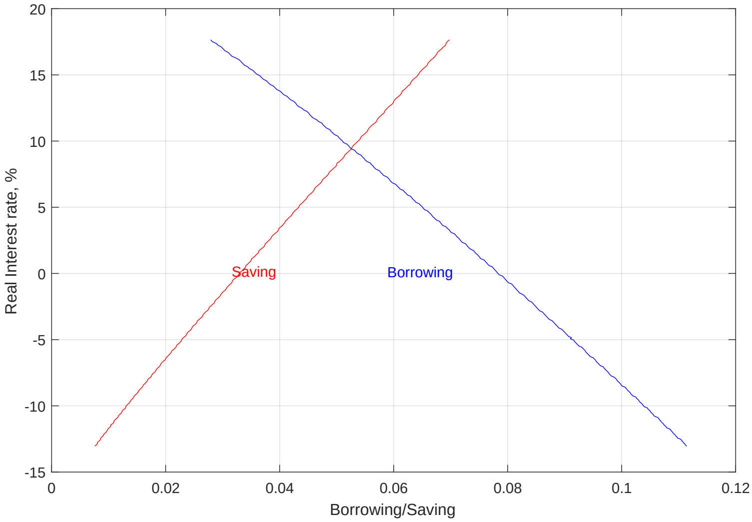
- Lender solves

$$\max_{b_\ell} u\left(1-qb_\ell\right)+\beta_\ell\left(\underbrace{\int_{\widehat{x(b)}}^{x_{\max}} u\left(x+\frac{b_\ell}{\pi(x)}\right)}_{\text{Repayment}}+\underbrace{\int_{x_{\min}}^{\widehat{x(b)}} u\left(x\right)}_{\text{Defaulted on}}\right)\mathrm{d}F\left(x\right)$$

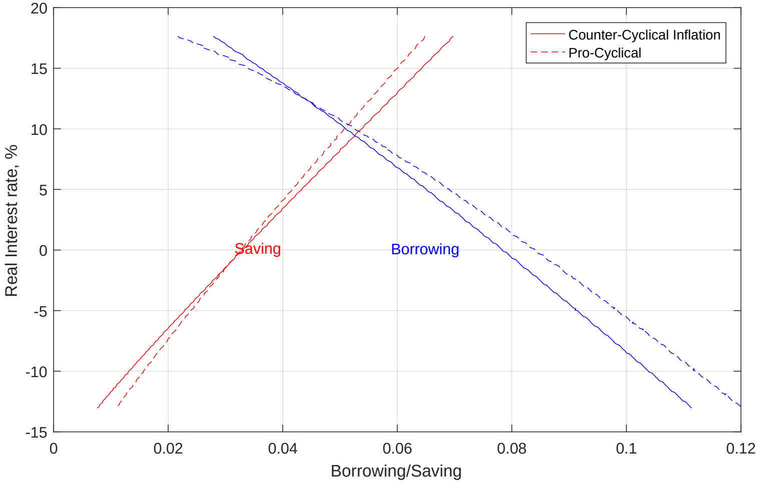
Default sets



Inflation and default



Inflation and default



Takeaways

- Without default more procyclical inflation reduces real rates

Takeaways

- Without default more procyclical inflation reduces real rates
- With default more procyclical inflation might increase real rates
- Counter-cyclical inflation implying low repayments in bad times, is substitute with default
- Pro-cyclical inflation, implying high repayments in bad times, is complement with default
- A country following procyclical inflation will face lower interest rate if not at default risk, but might face a sudden spike in rates in bad times

Quantitative Model

- Closed economy, discrete time $t = 0, 1, 2, \ldots$, one good
- Endowments y and inflation π follow a joint Markov process
- Agents
    - representative household (lenders)
    - government issues nominal bonds

Lenders

- Household (lender) preferences are given by

$$E_0 \sum_{t=0}^{\infty} \beta_\ell^t u_\ell(c_t)$$

  where $0 < \beta_\ell < 1$ is the time discount factor
- Lenders receive $(1 - \tau)y$

Government

- Government preferences are given by

$$E_0 \sum_{t=0}^{\infty} \beta_g^t u_g(g_t)$$

  where $0 < \beta_g < \beta_\ell < 1$ and g is government consumption

- Government revenue: τy

Government

- Government preferences are given by

$$E_0 \sum_{t=0}^{\infty} \beta_g^t u_g(g_t)$$

where $0 < \beta_g < \beta_\ell < 1$ and g is government consumption

- Government revenue: τy

- Given the option to default, the government chooses

$$V^o(B, s) \;=\; \max_{c,d} \left\{ V^c(B, s), V^d(B, s) \right\}$$

where B is incoming assets and $s = (\pi, y)$

Value of repayment

- The value, conditional on not defaulting, is given by

$$
\begin{aligned}
V^c(B,s) &= \max_{B'} \Big\{ u_g\left(\tau y - q(B,s,B')B' + B\right) \\
&\quad + \beta_g \mathbf{E}_{s'|s}\left[V^o\left(\frac{B'}{1+\pi'}, s'\right)\right] \Big\}
\end{aligned}
$$

  where $q(B,s,B')$ is the bond price

- Real yield is stochastic (even w/o default)

- In bad times, countercyclical inflation $\sim$ substitute to default

Value of default

- The value of default is given by

$$
\begin{aligned}
V^d(B,s) &= u_g\left(\tau\left(y-\phi^d(y)\right)\right) \\
&\quad +\beta_g \mathbf{E}_{s|s'}\left[\theta V^o\left(\frac{\lambda B}{1+\pi'}, s'\right)+(1-\theta)V^d\left(\frac{\lambda B}{1+\pi'}, s'\right)\right]
\end{aligned}
$$

$0 \leq \lambda \leq 1$: recovery rate,

Value of default

- The value of default is given by

$$V^d(B,s) = u_g\left(\tau\left(y-\phi^d(y)\right)\right) + \beta_g \mathbf{E}_{s|s'}\left[\theta V^o\left(\frac{\lambda B}{1+\pi'}, s'\right) + (1-\theta)V^d\left(\frac{\lambda B}{1+\pi'}, s'\right)\right]$$

$0 \leq \lambda \leq 1$: recovery rate,

$0 \leq \theta \leq 1$: probability of regaining access to credit, and

Value of default

- The value of default is given by

$$V^d(B,s) = u_g\left(\tau\left(y - \phi^d(y)\right)\right) + \beta_g \mathbf{E}_{s|s'}\left[\theta V^o\left(\frac{\lambda B}{1+\pi'}, s'\right) + (1-\theta) V^d\left(\frac{\lambda B}{1+\pi'}, s'\right)\right]$$

$0 \leq \lambda \leq 1$: recovery rate,

$0 \leq \theta \leq 1$: probability of regaining access to credit, and

$$\phi^d(y) = \max\left\{0, \frac{d_1}{d_0} y + \left(d_1 - \frac{d_1}{d_0}\right) y^2\right\}$$

quadratic cost of default where

- default cost at mean is $\phi^d(1) = d_1$
- default costs matter when $\phi^d(y) > 0$, when $y < 1 + d_0$

Bond price

In this environment, the bond price schedule satisfies

$$q(B,s,B') = \beta_\ell \mathbf{E}_{s'|s}\left[\frac{1-d^*\left(\frac{B'}{1+\pi'},s'\right)}{1+\pi'}\frac{u'_\ell\left(c'\right)}{u'_\ell\left(c\right)}\right] + \beta_\ell \mathbf{E}_{s'|s}\left[\frac{d^*\left(\frac{B'}{1+\pi'},s'\right)}{1+\pi'}\frac{q^d\left(\frac{B'}{1+\pi'},s'\right)u'_\ell\left(\left(1-\tau\right)\left(y'-\phi^d(y')\right)\right)}{u'_\ell\left(c\right)}\right]$$

where q^d is the price of a bond in default. default price

Cyclicality of inflation and borrowing costs

- With full default ($\lambda = 0$), the spread definition can be written as

$$\begin{aligned}
\text{spr}_t \approx & \underbrace{\Pr_t\left[d_{t+1} = 1\right]}_{\text{default premium}} \\
& + \textbf{cov}_t\left[\frac{m_{t,t+1}}{E_t\left[m_{t,t+1}\right]}, d_{t+1}\right] + \textbf{cov}_t\left[\frac{\mathbf{E}_t\left[1+\pi_{t+1}\right]}{1+\pi_{t+1}}, d_{t+1}\right] \\
& \underbrace{- \Pr_t\left[d_{t+1} = 0\right] \textbf{cov}_t\left[\frac{m_{t,t+1}}{E_t\left[m_{t,t+1}\right]}, \frac{\mathbf{E}_t\left[1+\pi_{t+1}\right]}{1+\pi_{t+1}}\right]}_{\text{procyclicality discount}}.
\end{aligned}$$

where $m_{t,t+1} = \beta_\ell \dfrac{u'_\ell(c_{t+1})}{u'_\ell(c_t)}$

- Spreads are increasing in default probability and decreasing in inflation cyclicality

Quantitative experiment

- Calibrate model with zero covariance to match spreads and conditional default probabilities in advanced economies
- Assess impact of different inflation processes on interest rates, debt dynamics, and crises

Functional forms

- Preferences

$$u_i(c) = \frac{c^{1-\gamma_i}}{1-\gamma_i} \text{ for } i = g, \ell$$

- Stochastic Process

$$\begin{bmatrix} \log y' \\ \pi' \end{bmatrix} = \begin{bmatrix} \rho_y & \rho_{\pi,y} \\ \rho_{y,\pi} & \rho_\pi \end{bmatrix} \begin{bmatrix} \log y \\ \pi \end{bmatrix} + \begin{bmatrix} \varepsilon_y \\ \varepsilon_\pi \end{bmatrix}$$

where

$$\begin{bmatrix} \varepsilon_y \\ \varepsilon_\pi \end{bmatrix} = N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_y^2 & \sigma_{\pi,y} \\ \sigma_{\pi,y} & \sigma_\pi^2 \end{bmatrix} \right)$$

Calibration – baseline with acyclical inflation

Parameters	Values	
		Joint targets
Gov't discount factor β_g	0.763	default prob. in good times: 1.02%*
Default cost cutoff d_0	–0.037	average spread: 0.74%**
Default cost at mean d_1	0.040	default prob. in bad times: 2.58%*
		VAR estimates – OECD cross section
Persistence ρ_y, ρ_π	0.80	
Spillovers $\rho_{\pi,y}, \rho_{y,\pi}$	0.00	
Volatility σ_y, σ_π	0.01	
Covariance of innovations $\sigma_{\pi,y}$	0.00	acyclical baseline $\pm$0.255e-4 (1.5 s.d.)
Lender discount factor β_ℓ	0.99	risk-free rate: 1 percent
Gov't risk aversion γ_g	2	
Lender risk aversion γ_ℓ	8	Storesletten, Telmer, Yaron (2007)
Probability of re-entry θ	0.10	average exclusion: 10 quarters†
Recovery parameter λ	0.96	recovery rate: 50%‡
Tax rate τ	0.19	OECD gov't consumption share

*: CDS-implied default probabilities 2001-2015 (threshold: 1 s.d. below trend consumption), **: Eurozone rates (in sample) less German rates 2001-2015, †: Richmond and Dias (2008), ‡: Benjamin and Wright (2009)

Results

- The procyclical inflation regime has
  - lower borrowing costs
  - despite more default crises
  - similar debt levels

	Positive co-movement (+1.5 s.d.)	Negative co-movement (−1.5 s.d.)
Default prob. (percent)	1.31	1.14
Spreads (percent) definition	0.67	0.71
Debt (percent borrower income)	5.55	5.57

decomposition of bond price

Procyclicality not always good

- The procyclical inflation economy has
  - lower borrowing costs during good times
  - higher borrowing costs during bad times, when output is more than 1 s.d. below mean
  - driven by larger increase in default probability

	Positive co-movement (+1.5 s.d.)	Negative co-movement (–1.5 s.d.)	Difference
Spreads overall (percent)	0.67	0.71	–0.04
Spreads in good times (pct)	0.54	0.60	–0.06
Spreads in bad times (pct)	1.52	1.40	+0.12
Def. prob. in good times (pct)	1.05	0.94	+0.11
Def. prob. in bad times (pct)	2.81	2.33	+0.48

Spreads for various covariances

Preferences for inflation cyclicality regime

- Government (Borrowers, Italy/Spain?) typically prefers countercyclicality
- Lenders (Germany?) prefer procyclicality
- Preferences strongly diverge in bad states

(a) Borrower (b) Lender

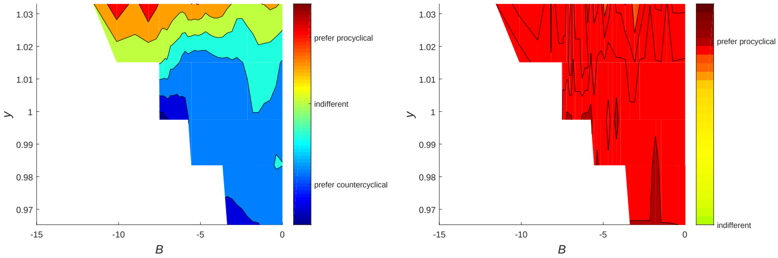


Figure: Welfare comparison of cyclicality regimes across states

Risk aversion, procyclicality discount, and default

- Procylical discount higher with lender risk aversion
- Debt crises remain more likely in bad times w/ procyclicality

Lender risk aversion γ_ℓ	Δ Spreads in good times (annual bp)	Δ Default probability in bad times (annual bp)
4	– 4	+20
8	– 6	+48
12	–17	+19
16	–33	+30

Conclusion

- In good times, the procyclical economy enjoys lower real rates
- In bad times, the risk of default increases more for the procylical economy which leads to higher real rates
- Recessions increase the contrast over monetary policy
- Potential explanation for the secular decline in real rates

Appendix

Domestic share of government debt is high back

	Year			
Country	2004	2008	2012	Mean
Australia	83.3	85.6	61.9	76.9
Belgium	50.7	41.0	58.9	50.2
Canada	77.6	83.8	72.1	77.8
Denmark	74.5	75.2	70.9	73.5
Finland	23.1	38.1	25.9	29.0
France	57.9	57.8	51.5	55.7
Germany	68.6	53.5	41.4	54.5
Italy	59.9	60.9	66.1	62.3
Japan	95.7	91.9	92.1	93.3
Netherlands	44.4	45.2	55.8	48.5
Norway	43.5	50.6	71.5	55.2
Portugal	24.0	27.3	35.9	29.0
Spain	55.7	62.6	78.1	65.5
Sweden	64.4	75.5	61.4	67.1
United Kingdom	81.9	78.1	72.4	77.5
United States	80.8	78.0	73.3	77.3
Mean	61.6	62.8	61.8	62.1

Sources: BIS, Haver

Conditional correlation between inflation and consumption growth

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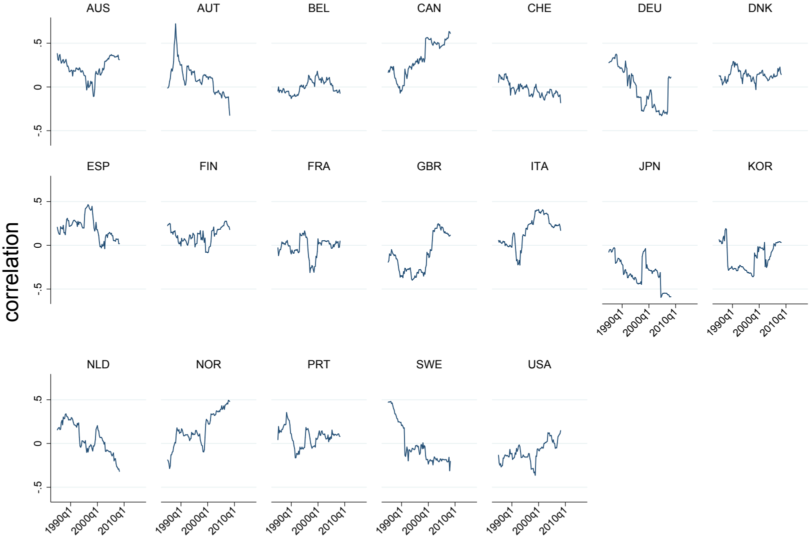

Procyc. discount stronger in good times back

	Real yield on government debt		
	(1)	(2)	(3)
Inflation consumption covariance	-1.804^{**}	-1.585^{**}	
	(0.636)	(0.658)	
Covariance*$\mathbf{1}_{\text{good times}}$		-0.949	-2.534^{***}
		(0.657)	(0.838)
Covariance*$\mathbf{1}_{\text{bad times}}$			-1.584^{**}
			(0.658)
$\mathbf{1}_{\text{good times}}$	Yes	Yes	Yes
other controls	Yes	Yes	Yes
adj. R^2	0.903	0.906	0.906
N	1726	1726	1726

$\mathbf{1}_{\text{good times}} \equiv$ average residual (predicted) default probability > 0. figure
Countries: AUS,AUT,BEL,CAN,CHE,DEU,DNK,ESP,FIN,FRA,GBR,
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Predicted default probability

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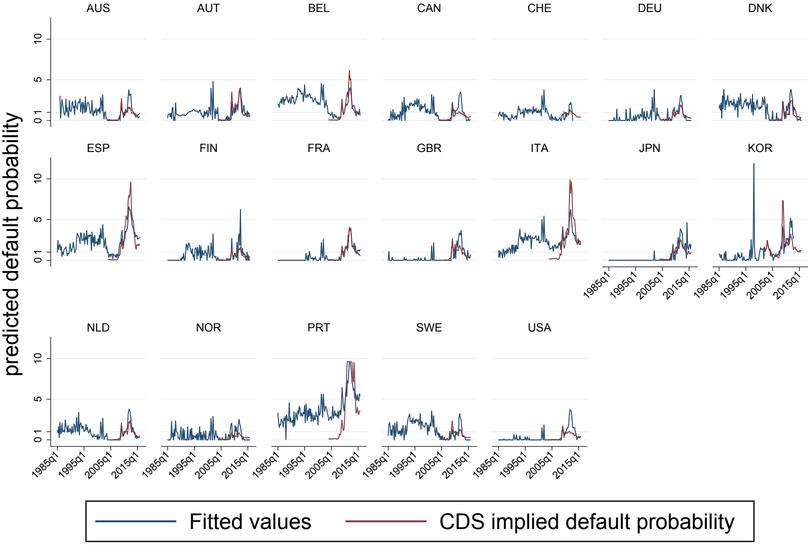


Bond price in default back

The price of a bond in default satisfies

$$q^d(B,s) = \beta_\ell \lambda \theta \mathbf{E}_{s'|s}\left[\frac{1-d^*\left(\frac{\lambda B}{1+\pi'}, s'\right)}{1+\pi'} \frac{u'_\ell\left(c'\right)}{u'_\ell\left(c_{def}\right)}\right]$$
$$+\beta_\ell \lambda \mathbf{E}_{s'|s}\left[\frac{1-\theta+\theta d^*\left(\frac{B'}{1+\pi'}, s'\right)}{1+\pi'} q^d\left(\frac{\lambda B}{1+\pi'}, s'\right) \frac{u'_\ell\left(c'_{def}\right)}{u'_\ell\left(c_{def}\right)}\right]$$

Measuring spreads in the model decomposition results

We measure spread as the real rate minus the risk-free rate:

$$\text{spr}_t = \frac{\frac{1}{q_{t+1}\mathbf{E}_t[1+\pi_{t+1}]} - \frac{1}{q^{RF}_{t+1}}}{\frac{1}{q_{t+1}\mathbf{E}_t[1+\pi_{t+1}]}} = 1 - \frac{q_{t+1}\mathbf{E}_t\left[1+\pi_{t+1}\right]}{q^{RF}_{t+1}}$$

where

$$q^{RF}_{t+1} = \mathbf{E}_t m_{t,t+1} = \beta_\ell \mathbf{E}_t\left[\frac{u'_\ell\left(c_{t+1}\right)}{u'_\ell\left(c_t\right)}\right]$$

Decomposition of bond price back

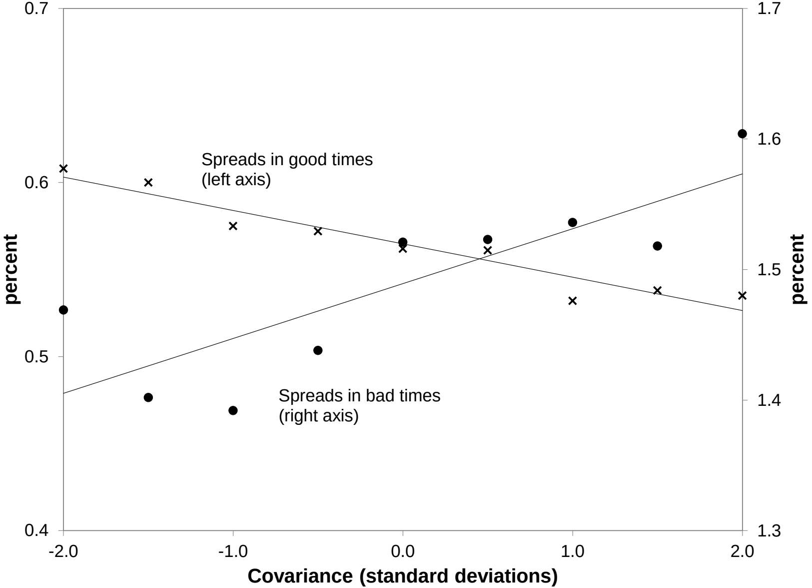
- The procyclical inflation economy has lower borrowing costs
- Driven by procyclicality of inflation, despite higher default

	Positive co-movement (+1.5 s.d.)	Negative co-movement (–1.5 s.d.)	difference (annual bp)
price $100 \times q$	99.09	99.07	+10
$100 \times \mathbf{E}\left[(1-d)\text{lsdf}\right]$	98.84	98.88	–15
$100 \times \mathbf{E}\left[d \times \text{lsdf}\right]$	0.232	0.197	+14
$cov\left(\text{defl}, (1-d)\text{lsdf}\right)$	0.009	-0.014	+9
$cov\left(\text{defl}, d \times \text{lsdf}\right)$	0.002	-0.001	+1

- 10 basis points accounts for 11 percent of the difference in data

Spreads for various covariances

back



Discount smaller in bad times with high γ_ℓ back

- Procyclicality discount overall
- Smaller in bad times
- Driven by a larger increase in default probability

	Positive co-movement (+1.5 s.d.)	Negative co-movement (–1.5 s.d.)	Difference
Spreads overall (percent)	0.62	1.11	–0.49
Spreads in good times (pct)	0.41	0.92	–0.51
Spreads in bad times (pct)	1.91	2.33	–0.42
Def. prob. in good times (pct)	0.64	0.93	–0.29
Def. prob. in bad times (pct)	2.34	2.46	–0.12

Decomposition of bond price with high γ_ℓ back

- The procyclical inflation economy has lower borrowing costs
- Driven by procyclicality of inflation and lower default

	Positive co-movement (+1.5 s.d.)	Negative co-movement (–1.5 s.d.)	difference (annual bp)
price $100 \times q$	99.78	99.65	+50
$100 \times \mathbf{E}\left[(1-d)\text{lsdf}\right]$	99.59	99.48	+45
$100 \times \mathbf{E}\left[d \times \text{lsdf}\right]$	0.157	0.200	–17
$cov\left(\text{defl}, (1-d)\text{lsdf}\right)$	0.026	-0.030	+23
$cov\left(\text{defl}, d \times \text{lsdf}\right)$	0.001	-0.001	+1

- 24 basis points accounts for 26 percent of the difference in data
- Default increases overall effect of cyclicality

Inflation-indexed bonds

- With inflation-indexed bonds:
  - defaults less
  - intermediate spread

	Inflation-indexed bonds	Positive co-movement (+1.5 s.d.)	Negative co-movement (−1.5 s.d.)
Default prob. (percent)	1.13	1.31	1.14
Spreads (percent) definition	0.69	0.67	0.71
Debt (percent borrower income)	5.49	5.55	5.57

Robust to alternative yield measures

	Real sovereign yield		
	(1)	(2)	(3)
Yield source	IFS	Fame 5-year	Fame 10-year
Inflation consumption	-1.804**	-1.453	-1.485
covariance	(.636)	(.924)	(1.117)
other controls	Yes	Yes	Yes
adj. R^2	0.903	0.891	0.918
N	1726	1140	1389

Countries: AUS,AUT,BEL,CAN,CHE,DEU,DNK,ESP,FIN,FRA,GBR, ITA,JPN,KOR,NLD,NOR,PRT,SWE,USA.

Standard errors clustered by country. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions include country and time fixed effects

Robust to alternative debt measures

	Real sovereign yield			
	(1)	(2)	(3)	(4)
Debt source	Oxford & OECD	OECD	Oxford	OECD & Oxford
Inflation consumption covariance	-1.804**	-1.351	-1.819***	-1.672**
	(.636)	(1.594)	(0.557)	(0.640)
other controls	Yes	Yes	Yes	Yes
adj. R^2	0.903	0.816	0.912	0.906
N	1726	918	1556	1731

Countries: AUS,AUT,BEL,CAN,CHE,DEU,DNK,ESP,FIN,FRA,GBR,
ITA,JPN,KOR,NLD,NOR,PRT,SWE,USA.

Standard errors clustered by country. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions include country and time fixed effects