R-star and the interplay between demographics and financial integration

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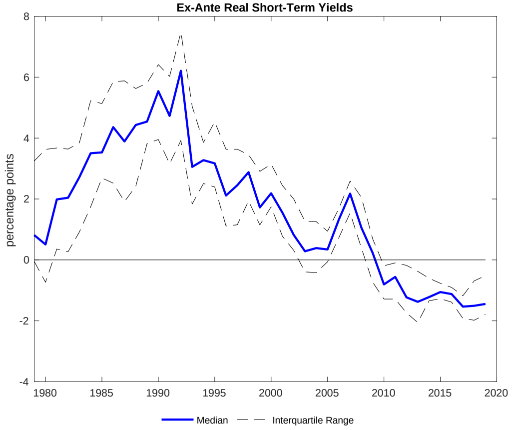
Slides based on "Demographics and Real Interest Rates Across Countries and Over Time"
Carvalho, Ferrero, Mazin, and Nechio (2025)

Demographics and Real Interest Rates Across Countries and Over Time

- Between 1990 and 2019, real interest rates
    - exhibited a pronounced and persistent decline
    - narrowed across countries
- Identifying trends behind real rates is key to understand this decline and path ahead
    - Carvalho et al. (2016) focused on roles of longevity and population growth in a closed economy
- Carvalho et al. (2025) focus on the role and interplay between demographics and financial integration



Note: Median and interquartile range of ex-ante real short-term interest rates for 19 OECD countries between 1979 and 2019.

Carvalho et al. (2025) in a nutshell

- Model setup and findings
  - Develop a multicountry life-cycle model with *imperfect* capital mobility Model overview
    - Workers have some probability of retiring and retirees of surviving
    - Imperfect capital mobility due to portfolio-holding costs
    - Real rates depend on both country-specific and global demographics
  - Demographic transition implies a significant decline in real rates
  - Financial integration shifts the sensitivity of real interest rate towards global determinants and narrows cross-country real rates Baseline experiment
- Empirical analysis
  - Panel error correction model (ECM) to assess role of demographics, financial integration, and other potential drivers
  - Estimates consistent with model predictions on the roles of demographics and financial integration

Empirical approach and data

- Estimate ECM to account for low-frequency movements
  - Regress real interest rates on demographic variables
  - Account for measures of financial integration
  - Control for other potential drivers
    - TFP growth, government debt, pension spending, convenience yields, inequality
- Annual frequency data from various sources (World Bank, IMF, OECD, UN)
- Unbalanced panel of 19 OECD countries with data from 1979 to 2019
  - Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States

Regression specification

- Interaction of variables with degree of financial openness
  - $\Theta_{m,t} = \frac{LMF_{m,t}}{100+LMF_{m,t}}$, LMF is sum of financial assets and liabilities/GDP
- Global factors summarized by a global real rate variable
  - $r^*_{m,t} = \sum_{\ell \neq m} \left(\frac{\Theta_{\ell,t} POP_{\ell,t}}{\sum_{\ell \neq m} \Theta_{\ell,t} POP_{\ell,t}} \right) \times r_{\ell,t}$ is the global rate faced by country m
- $r_{m,t}$ is short-term rate minus one-year-ahead expected inflation

$$\Delta r_{m,t} = \alpha_m + \gamma r_{m,t-1} + \theta \Theta_{m,t-1} r^*_{m,t-1} + \sum_j \psi_j (1 - \Theta_{m,t-1}) D_{m,j,t-1} + \sum_k \Psi_k (1 - \Theta_{m,t-1}) X_{m,k,t-1}$$
$$+ \lambda \Delta(\Theta_{m,t} r^*_{m,t}) + \sum_j \phi_j \Delta[(1 - \Theta_{m,t}) D_{m,j,t}] + \sum_k \chi_k \Delta[(1 - \Theta_{m,t}) X_{m,k,t}] + \epsilon_{m,t},$$

- Report $\frac{-\hat{\theta}}{\hat{\gamma}}$ and $\frac{-\hat{\psi}_j}{\hat{\gamma}}$

	(1)	(2)	(3)	(4)	(5)	(6)
Global Rate	0.68***	0.66***	0.70***	0.74***	1.00***	1.48***
	(0.17)	(0.17)	(0.13)	(0.14)	(0.20)	(0.20)
Life Expectancy	0.14***	0.14***	-0.24***	-0.17	-0.36***	-0.54*
	(0.04)	(0.04)	(0.06)	(0.19)	(0.09)	(0.28)
Growth Rate of Labor Force	0.24	0.30	6.03***	6.12***	8.95***	11.59***
	(1.02)	(1.01)	(0.98)	(1.10)	(1.51)	(1.49)
TFP Growth		0.49	0.02	-0.14	-0.02	-0.01
		(0.34)	(0.30)	(0.37)	(0.39)	(0.41)
Government Debt			0.03	0.01	0.07**	0.10**
			(0.02)	(0.03)	(0.03)	(0.04)
Pension Spending			2.31***	2.11***	2.12***	2.65***
			(0.41)	(0.59)	(0.53)	(0.80)
Gini Coefficient				-0.05		-0.03
				(0.23)		(0.33)
Convenience Yield					0.67	1.99
					(1.35)	(1.68)
Lagged real rate	-0.31***	-0.32***	-0.46***	-0.50***	-0.53***	-0.68***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.06)	(0.06)
Kao test	R***	R***	R***	R***	R***	R***
R-Squared	0.24	0.24	0.39	0.36	0.53	0.55
Adjusted R-Squared	0.21	0.22	0.35	0.31	0.48	0.48
Observations	743	743	505	445	206	169
Clusters	19	19	19	18	7	7

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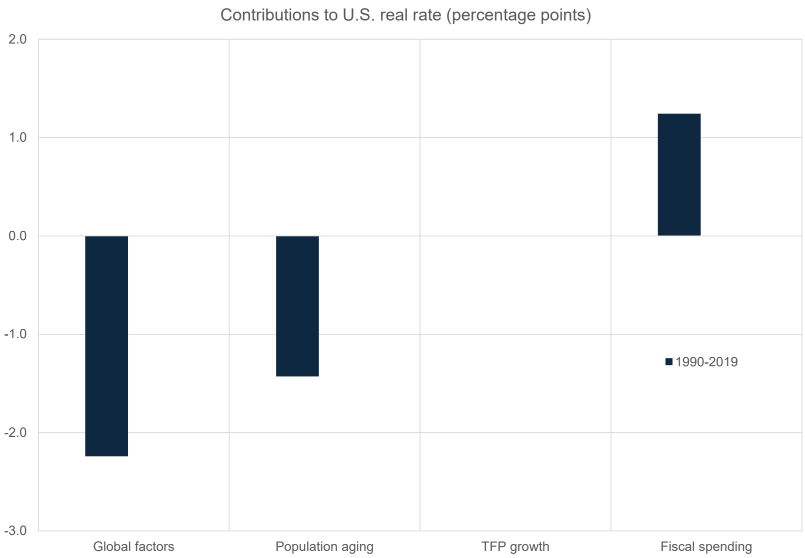
Recent trends underlying U.S. rates

- Focusing on panel estimates from specification (3)
- Apply to U.S. data to obtain drivers' contributions to the decline in U.S. rates:
  (a) Calculate the change of each U.S. driver over the subsamples
  (b) Compute the average degree of integration and its complement
  (c) Obtain contributions from estimated coefficients
- Sample periods
  - 1990-2019
  - 2019-2023 (subject to many caveats)

Contributions to U.S. real rate movements



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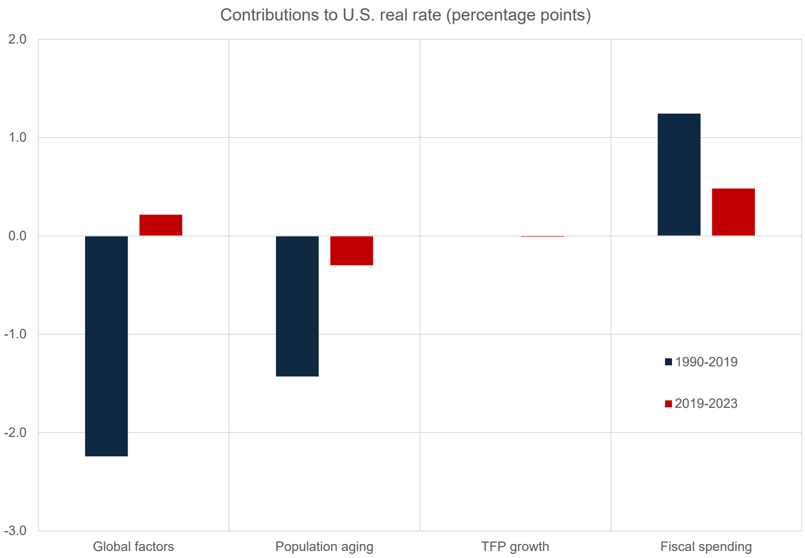

Conclusion

- Real rates persistently declined and narrowed across countries between 1990 and 2019
- Financial integration and demographic trends help explain the decline and narrowing of r-star over time and across countries (Carvalho et al., 2025)
- Empirical relationships applied to U.S. data suggest
  - Pre-pandemic decline largely driven by U.S. population aging and global factors
  - Fiscal spending pushed U.S. real rates up
  - Patterns since the pandemic may have changed somewhat
  - Estimates are not indicative of trends going forward

Extra slides

Regression results abstracting from the interaction with financial openness

	(1)	(2)	(3)	(4)	(5)	(6)
Global Rate	0.32**	0.30**	-0.23	-0.36***	-0.24	-0.21
	(0.13)	(0.13)	(0.15)	(0.13)	(0.21)	(0.17)
Life Expectancy	-0.76***	-0.72***	-1.49***	-1.43***	-0.95***	-1.07***
	(0.14)	(0.13)	(0.16)	(0.16)	(0.30)	(0.31)
Growth Rate of Labor Force	-0.58	-0.41	0.58	0.04	1.64**	1.16*
	(0.35)	(0.36)	(0.41)	(0.36)	(0.74)	(0.63)
TFP Growth		0.31**	0.24*	0.05	0.34*	0.16
		(0.14)	(0.14)	(0.14)	(0.20)	(0.19)
Government Debt			0.01	-0.02**	0.01	-0.02*
			(0.01)	(0.01)	(0.01)	(0.01)
Pension Spending			0.47**	-0.03	0.71**	0.05
			(0.21)	(0.20)	(0.28)	(0.26)
Gini Coefficient				0.08		-0.00
				(0.09)		(0.14)
Convenience Yield					-1.90**	-0.53
					(0.85)	(0.78)
Lagged real rate	-0.33***	-0.34***	-0.42***	-0.53***	-0.48***	-0.66***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)
Kao test	R***	R***	R***	R***	R***	R***
R^2	0.24	0.24	0.30	0.31	0.50	0.54
Adjusted R^2	0.21	0.21	0.25	0.26	0.44	0.46
Observations	743	743	505	445	206	169
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back

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Model overview

- Open-economy life-cycle model with imperfect capital mobility
    - Demographic trends (Gertler, 1999) are time-varying and heterogeneous across countries (Ferrero, 2010)
    - Portfolio-holding costs hamper free capital mobility (Chang et al., 2015)
- In each country $m \in 1, ..., \mathcal{M}$, a continuum of workers and retirees:
    - Face idiosyncratic risk of retirement (for workers) and death (for retirees)
    - Consume one good and can save through capital, government bonds, or claims on foreign assets, the latter with a cost
- Standard supply side (labor-augmenting productivity)
- Government funds spending and transfers with taxes and debt

back

Demographics

- Simple life-cycle structure (Gertler, 1999):
  - Each period, $(1 - \omega_{mt} + n_{mt})N^w_{mt-1}$ new workers are born in country m
  - Workers remain in labor force with probability ω_{mt}, otherwise retire
  - Once retired, survive with probability γ_{mt}
- Growth rate of labor force:

$$N^w_{mt} = (1 + n_{mt})N^w_{mt-1}$$

- Old dependency ratio:

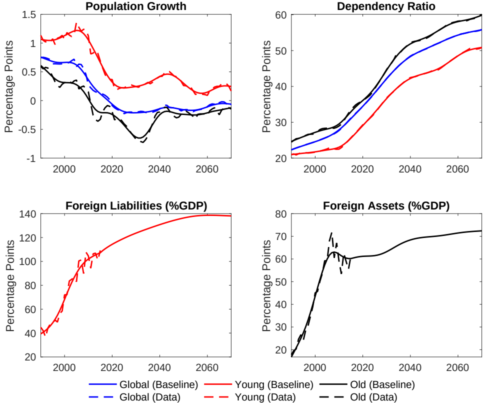
$$\psi_{mt} \equiv \frac{N^r_{mt}}{N^w_{mt}} = \frac{(1 - \omega_{mt}) + \gamma_{mt}\psi_{mt-1}}{1 + n_{mt}}$$

back

Experiments: baseline

- Transition driven by evolution of demographics and portfolio-holding costs back
- Feed the model with (HP filtered) data from 1990-2020 and use projections for 2020-2070

Calibration



Simulation