Bond Convenience Curves and Funding Costs

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Introduction

- Consider two EUR-denominated investments with same duration
  1. buy a German bond
  2. buy a synthetic safe bond: Italian bond + CDS
- Both have same cash flows $\Rightarrow$ yields should equal
- The latter trades on average at 40bps higher yield, gap spikes in a crisis

Introduction

- The gap has several names: inconvenience yield (Jiang et al. 22), CDS-bond basis, segmentation premium
- **Explanation**: the funding cost of the latter position higher and also uncertain
- We provide a new framework to understand the effects of funding costs on bond yields
- We provide novel causal evidence for the key mechanism

Practical Explanation

- Key financial intermediaries in the bond market rely on external financing
- Bonds can be financed through repo market or through more expensive unsecured funding sources (unsecured loans, deposits etc.)
- Repos collateralized with German and Italian bonds trade in different segments
- Funding cost of Italian bond higher due to higher haircut (and repo rate).
- Higher funding costs priced in Italian bond yields
- Argue that funding risks also priced in Italian bond yields

Relation to Literature

1. Convenience yields
   - Krishnamurthy & Vissing-Jorgensen 12: Treasuries give liquidity benefits similar to those of money
   - Paper attempts to take a step closer to building a microfounded model of convenience yields in a currency union
2. Asset pricing with frictions (e.g. Garleanu & Pedersen 11; Jylhä 18; Choi, Shachar and Shin 19)
3. Segmentation/fragmentation in eurozone sovereign bond markets
   - New policy interest due to ECB's TPI (announced July 2022)

Data

- Focus on 9 eurozone countries: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Portugal, and Spain
- Obtain yields and CDS quotes from Datastream
- First use benchmark yields, later yields of all outstanding Italian bonds
- τ maturity inconvenience yield of country i relative to Germany is

$$icy_t^i(\tau) = y_t^i(\tau) - cds_t^i(\tau) - (y_t^{DE}(\tau) - cds_t^{DE}(\tau)),$$

- $y_t^i(\tau)$ is bond yield and $cds_t^i(\tau)$ is the corresponding CDS premium.

Stylized Fact 1

Riskier bonds, as measured by CDS premia, command higher inconvenience yields (weaker time-series relation)

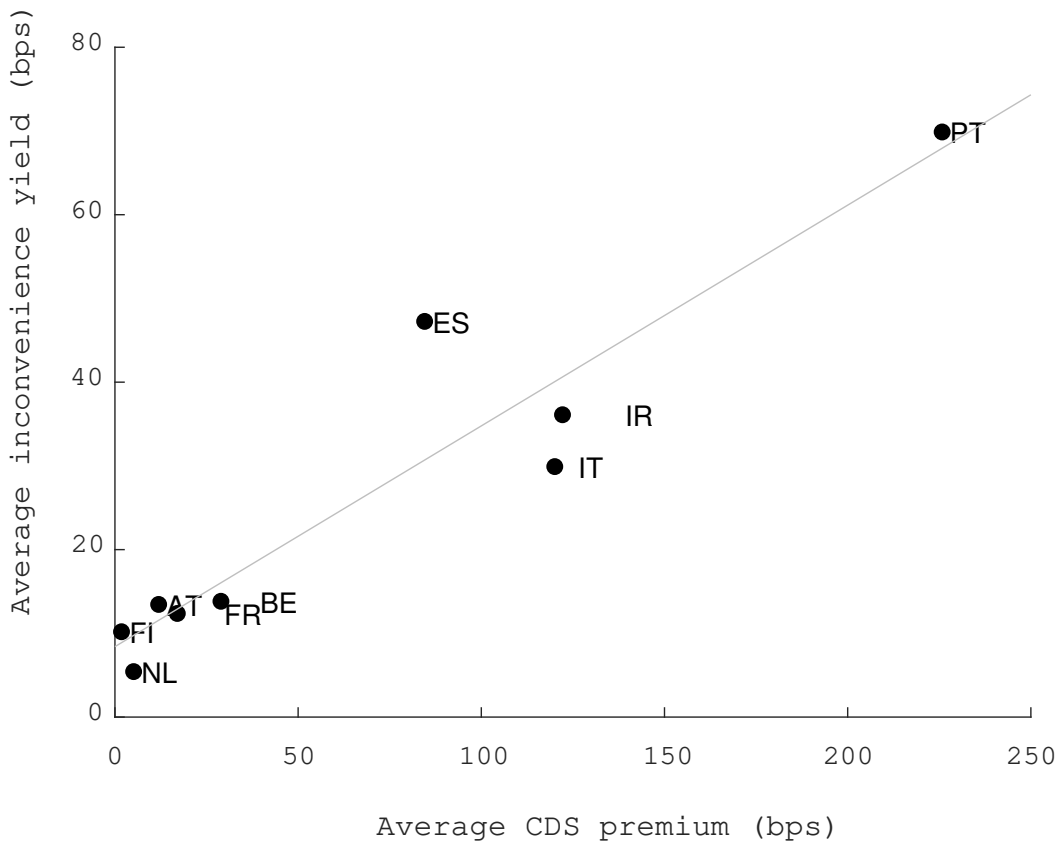

Figure: plots the average inconvenience yield for each country against the corresponding average CDS premium.

Stylized Fact 2

Inconvenience yields are associated with measures of funding costs and funding risks.

	(1) ICY $(\overline{icy}_t^i)$	(2) ICY $(\overline{icy}_t^i)$	(3) ICY Slope $icy_t^i(10Y) - icy_t^i(1Y)$	(4) ICY Change $\Delta^{1M} icy_t^i(1Y)$
CDS diff. $(\overline{cds}_t^i - \overline{cds}_t^{DE})$	0.037*			
	(1.79)			
Repo rate diff.		0.80**		
		(2.19)		
Repo rate vol.			3.24***	
			(3.47)	
ICY Slope $icy_t^i(10Y) - icy_t^i(1Y)$				0.106***
				(2.61)
R^2	0.084	0.140	0.050	0.042
Country fixed effects	x	x	x	x
Note:				*p<0.1; **p<0.05; ***p<0.01

Stylized Fact 3

The inconvenience curve is upward sloping on average

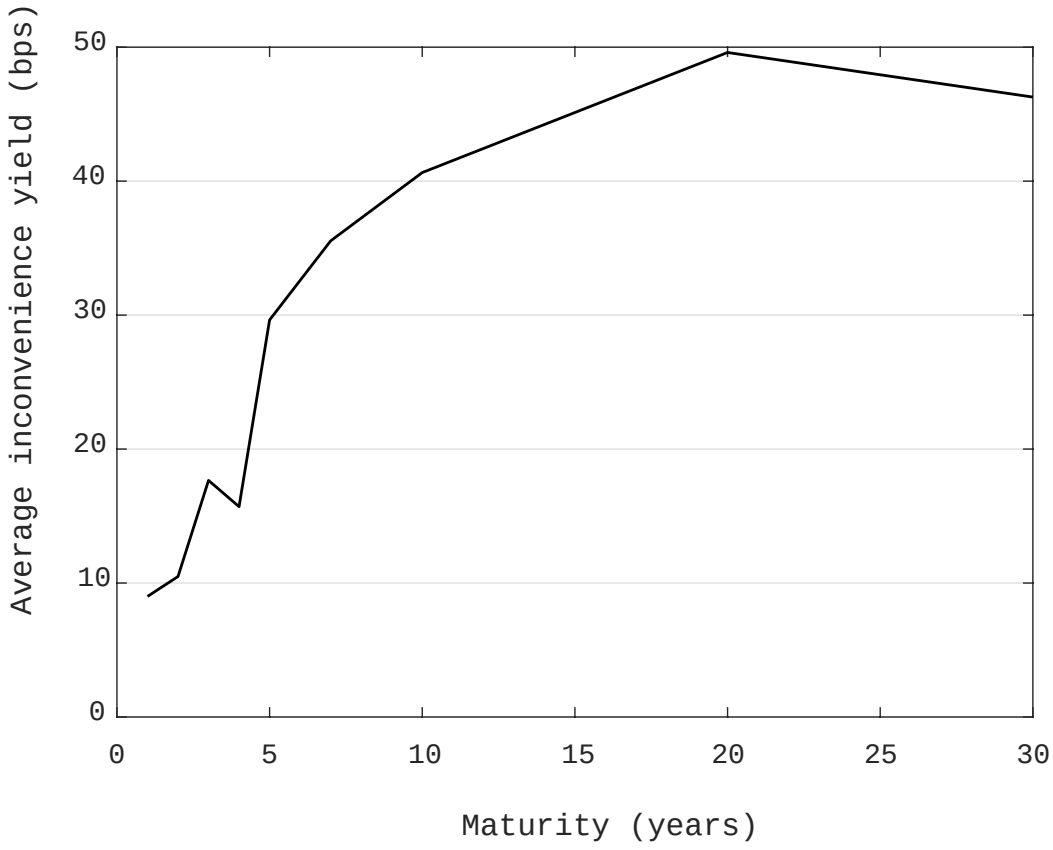

Figure: shows the average term structure of inconvenience yields. For each maturity the inconvenience yields are averaged both over time and countries.

Stylized Fact 4

An increase in the spread between long and short maturity inconvenience yields predicts future increases in short term inconvenience yields

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Model: Structure

- Builds on Vaynos & Vila (20) but with two countries and differential bond funding costs
- Time is continuous
- Two countries, core and periphery, issue a continuum of zero coupon bonds
- Debt issued by core riskless but that issued by periphery not
- Default given by a Poission jump process with default intensity ψ and severity δ
- An arbitrageur (banks + hedge funds) trades all bonds

Model: Structure

- The arbitrageur maximizes:

$$\mathbb{E}(dW_t) - \frac{\gamma}{2}\mathbb{V}ar(dW_t)$$

- where wealth dynamics $dW_t - W_t r_t dt$ given by

$$\int_0^T X_t^\tau \left(\frac{dP_t^\tau}{P_t^\tau} - r_t\right) d\tau + \int_0^T \bar{X}_t^\tau \left(\frac{d\bar{P}_t^\tau}{\bar{P}_t^\tau} - r_t - \Lambda_t\right) d\tau - \delta \bar{B}_t dN_t$$

- X_t^τ and $\bar{X}_t^\tau$ are bond holdings, $\bar{B}_t = \int_0^T X_t^\tau d\tau$, r_t and $r_t + \Lambda_t$ are the funding costs of core and periphery bonds

Modelling Funding Costs

- Bond funding costs depend on risk as well as overall bond funding market liquidity.
- Key assumptions $\Lambda_t \geq 0$ and uncertain.

$$\Lambda_t =$$

$$\text{Constant} \times \text{Default probability} \times \text{Amount of bonds financed} \equiv \lambda B_t^*$$

- Similar to He et al. 22.
- Can justify the dependence on B_t^* with some increasing operational marginal costs for lenders
- Separate literature attempts to endogenize the use of repo contracts etc. (e.g. Gottardi et al. 19)

Model: Structure

- Also preferred habitat investors with demands given by

$$Z_t^\tau = -\theta(\tau)\beta_t, \quad \bar{Z}_t^\tau = -\bar{\theta}(\tau)\beta_t \tag{1}$$

- Here β_t is a demand shock given by continuous time Markov chain
- Demand shock induces funding risk since it implies arbitrageurs must finance more bonds.
- Short rate process (not important):

$$dr_t = \kappa(\bar{r} - r_t) + \sigma dz_t. \tag{2}$$

Model: Results

- Model admits an affine solution for the prices of core, periphery and synthetic safe bonds as well as CDS premia.
- These depend on maturity, level of short rates and the demand shock

Proposition 2 *We can decompose a τ-maturity inconvenience yield to an expected funding cost component and a funding risk component:*

$$icy(\tau) \approx \frac{1}{\tau}\mathbb{E}_t \int_t^{t+\tau} \Lambda_s ds + Funding\ risk_t$$

Here $icy_t(\tau) \to \Lambda_t$ as $\tau \to 0$. The short end of the convenience yield curve is determined by the current funding cost. The long end also reflects expected future funding costs and a funding risk premium.

Model: Results, Italy & Spain

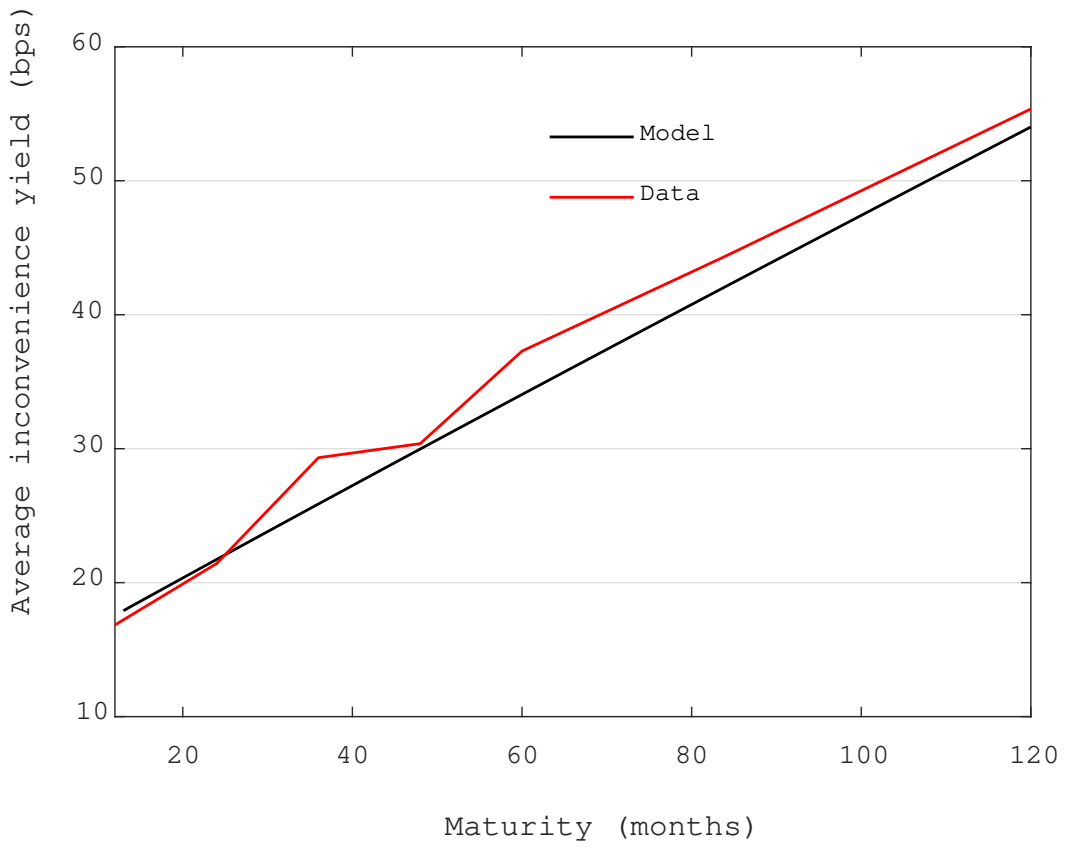

Figure: shows the average term structure of inconvenience yields for Italy and Spain as well as that implied by the calibrated model.

Funding Costs and Yields: Causal Evidence

- Bond haircuts important determinants of effective funding costs.
- Collateralized funding can be obtained either from the private repo market or Eurosystem
- Eurosystem rates tend to be higher, especially the MRO
- Haircuts similar for safe bonds but (in our sample) Eurosystem haircuts lower for risky bonds
- Eurosystem funding can be competitive for risky bonds
- Use Eurosystem haircuts for all outstanding Italian bonds

Eurosystem Haircuts

AAA to A-			BBB+ to BBB-		
Residual Mat	Fixed coupon	Zero coupon	Residual Mat	Fixed coupon	Zero coupon
0-1	0.5	0.5	0-1	6	6
1-3	1	2	1-3	7	8
3-5	1.5	2.5	3-5	9	10
5-7	2	3	5-7	10	11.5
7-10	3	4	7-10	11.5	13
> 10	5	7	>10	13	16

Table: ECB haircuts for Category I assets (debt issued by central governments) in late 2013

- Map all eligible Italian bonds to Eurosystem haircuts
- Focus on haircut changes due to switches in maturity buckets
- Switches depend only on bond's issue date, current date and the thresholds
- For each bond switching buckets there is a control group of similar bonds that don't

Eurosystem Haircuts

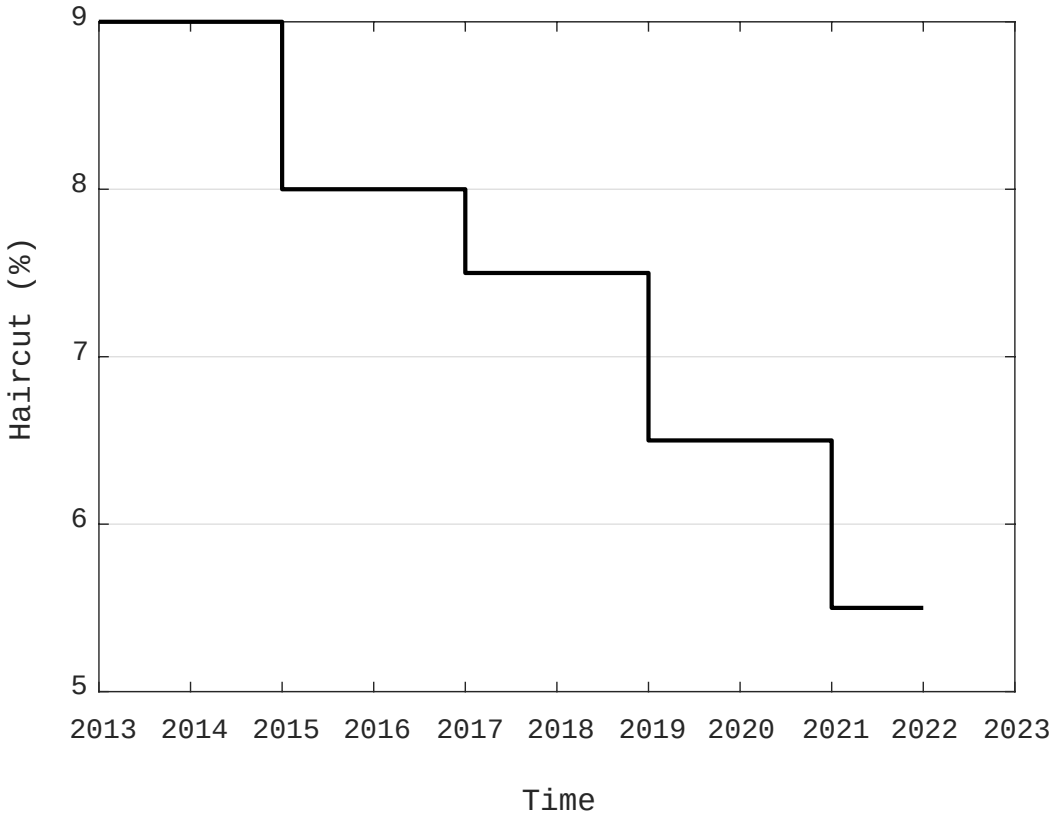

Figure: shows the haircut schedule for a bond in the 2nd credit rating category with a tenor of 10 years in November 2012.

Effects of Eurosystem Haircuts on Italian Yields

	Yield Change Δy^{IT}				
	(1)	(2)	(3)	(4)	(5)
HCI	-0.41	-0.19	-0.18		-0.17
	(-0.82)	(-0.72)	(-0.67)		(-0.65)
*HCI*1	-1.62***	-0.62**	-0.60**		-0.59**
	(-3.16)	(-2.56)	(-2.51)		(-2.45)
*HCI*2	-0.65	-0.32	-0.30		-0.29
	(-1.26)	(-1.64)	(-1.54)		(-1.49)
HCIALL				-0.36***	
				(-3.06)	
# of Obs.	667107	667107	667107	667107	667107
R^2	0.00008	0.00003	0.00003	0.00002	0.00009
Bond fixed effects			x	x	
Time fixed effects		x	x	x	x
Category fixed effects					x
Note:					*p<0.1; **p<0.05; ***p<0.01

Summary: Effects of Eurosystem Haircuts on Italian Yields

- Main specification includes bond and time fixed effects
- Change in haircut, due to a maturity category shift, leads to 1bps lower yield
- Haircuts fall on average by a bit less than 1%
- Driven by inconvenience yield portion.

Convenience yields and unconventional monetary policy

Policy	ICY Share
Collateral Policy Changes	66 %
Securities Market Program	39 %
Outright Monetary Transactions Program	9 %
Draghi Whatever-It-Takes Speech	15 %
Extended APP	36 %
PEPP	54 %
Liquidity Support	38 %
Average	48 %

Table: shows the share of yield spread changes around monetary policy announcements that are due to changes in inconvenience yields.

Conclusion

- Two assumptions explain eurozone sovereign convenience curves:
  - Funding costs on riskier bonds higher
  - Funding costs uncertain and arbitrageurs risk averse
- Use exogeneous changes in Eurosystem haircuts to find causal evidence that funding costs affect yields
- Changes in inconvenience yields key for monetary policy transmission to yields spreads