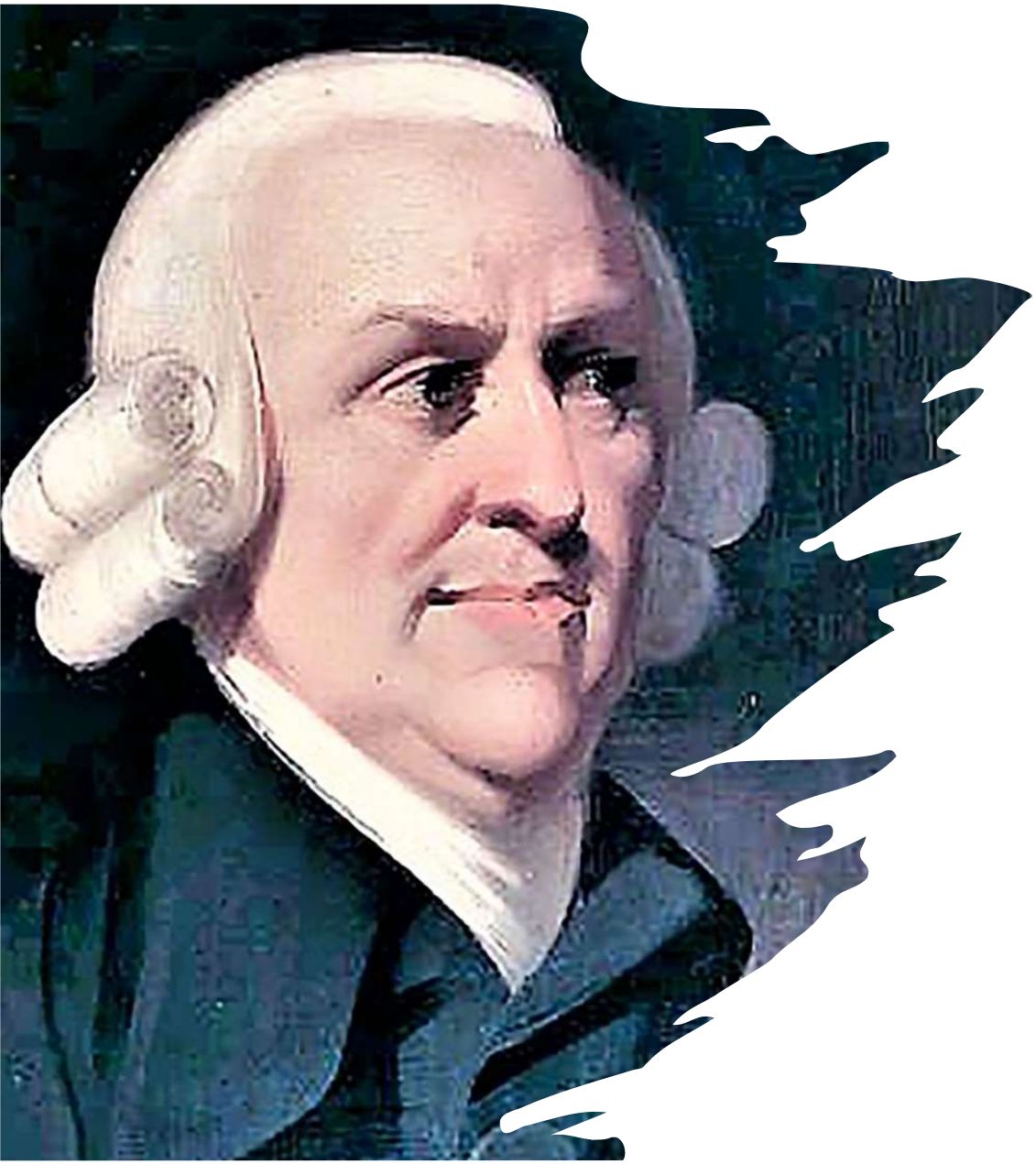

Valuation Adjustments, Banks' Capital Structure and Asset Pricing

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Summary

- Financial Markets post-2008 have seen significant changes and not only regulatory ones (capital structure of banks).
- These changes have introduced pervasive shifts in banks' availability to intermediate assets, exactly when it is needed the most.
- Today I shall discuss these news changes and the implications for financial markets and asset pricing.
- Capital structure-asset pricing: at odd with Modigliani and Miller (1958)?

Valuation Adjustments (VAs)

- Following 2008 financial crisis banks and (soon after) accounting firms have largely accepted the introduction of VAs.
- Credit Value Adjustment (CVA): CVAs existed before the 2008 financial crisis.
- Debit Value Adjustment (DVA) is quite counter intuitive: this involves reporting a gain as the bank's own credit risk increases.
- Funding Value Adjustments (FVA)
- Banks have invested a lot on setting these new desks after 2008 and set the necessary infrastructure but yet VAs desks not integrated!

Valuation Adjustments: Swaps with Up-Front Payments

- Suppose that V_t is the (portfolio) value of the swap at time t to the dealer and assume that no default contract is V_t^* (we follow Hull and White, 2014 here)

- $$V_t = V_t^* - CVA_t + DVA_t \qquad (1)$$

- This swap requires an up-front payment, the dealer finances this by writing commercial paper

- $$V_t = V_t^* - CVA_t + DVA_t - FVA_t \qquad (2)$$

- As it is FVA in eq (2) does not account for credit risk (its in DVA already!)

Valuation Adjustments: Swaps with Up-Front Payments

- To see this divide DVA_t into DVA_t^1 (default on derivatives-swap) and DVA_t^2 (default on funding). It follows that that $FVA_t = DVA_t^2$, eq (2)

- $$V_t = V_t^* - CVA_t + DVA_t \qquad (3)$$

- Although CVA and DVA adjustments are now accepted in the industry and by accounting firms, but FVA is controversial, Anderson et al (2019). We focus on FVA and DVA.
- Eq (3) is the value of the swap which makes “indifferent” equity and bond-holders to enter the swap. What is its value to shareholders?

Valuation Adjustments: Swaps with Up-Front Payments

- From Proposition 3 in Anderson et al (2019)

$$V_t^S = (V_t - DVA_t)\frac{R}{R+S} \qquad (4)$$

Where R is the risk-free rate and S the dealer credit spread.

- The dealer removes DVAs from the swap price as there is no incentive for shareholders to pay less than the contractual value of the swap given that at default they get nothing! The difference (4)-(3), $V_t^S - V_t$, debt overhang cost!

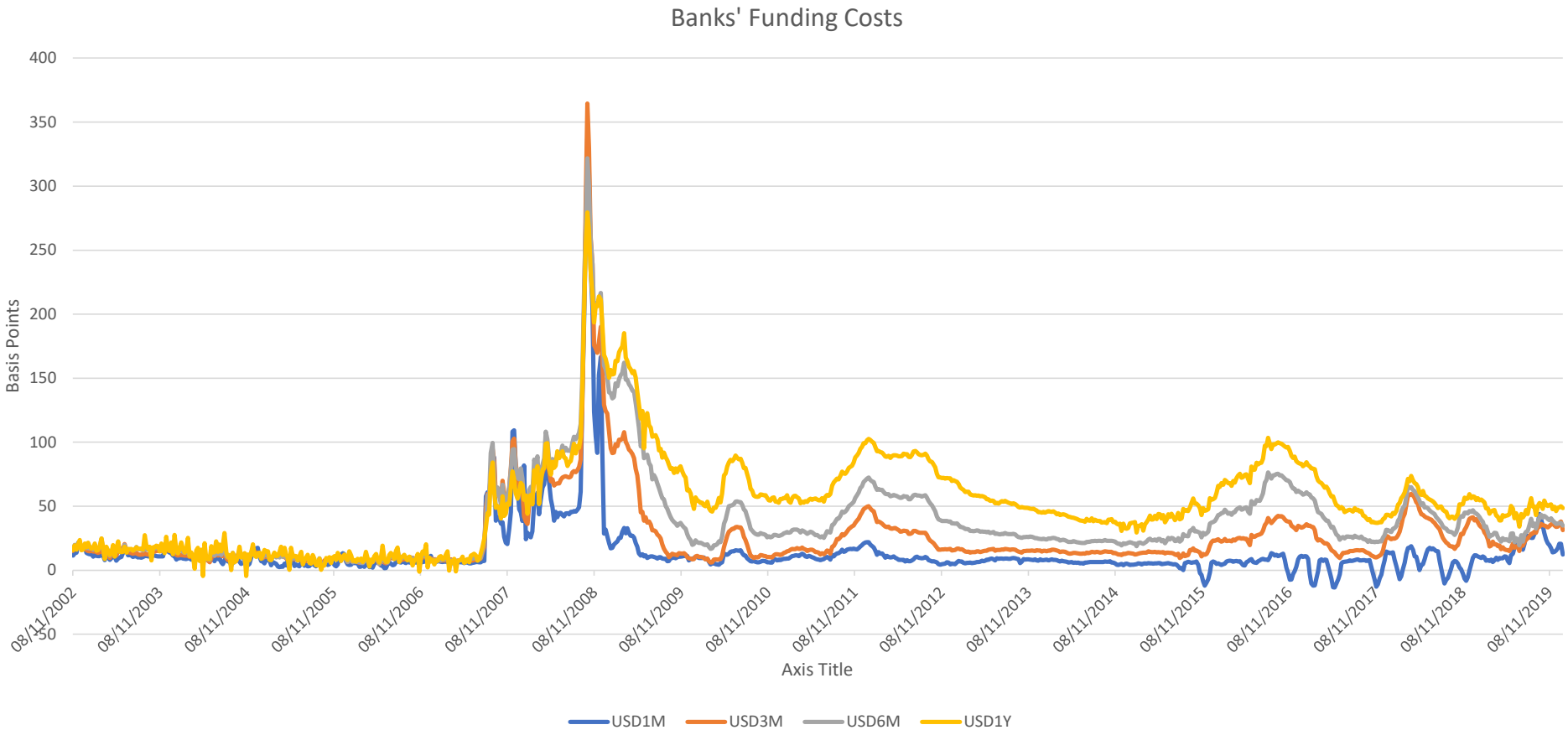
Valuation Adjustments: Swaps with Up-Front Payments

- If (4)-(3) is debt overhang cost, how would the dealer compensate shareholders?
- This can be achieved by setting bid-ask spreads to align the swap price to shareholders break-even.
- $$V_t^S = V_t - DVA_t - FVA_t \qquad (5)$$
- Indeed consistent with (5) dealers have always quoted prices net of DVA and FVA (not as in eq 3)!

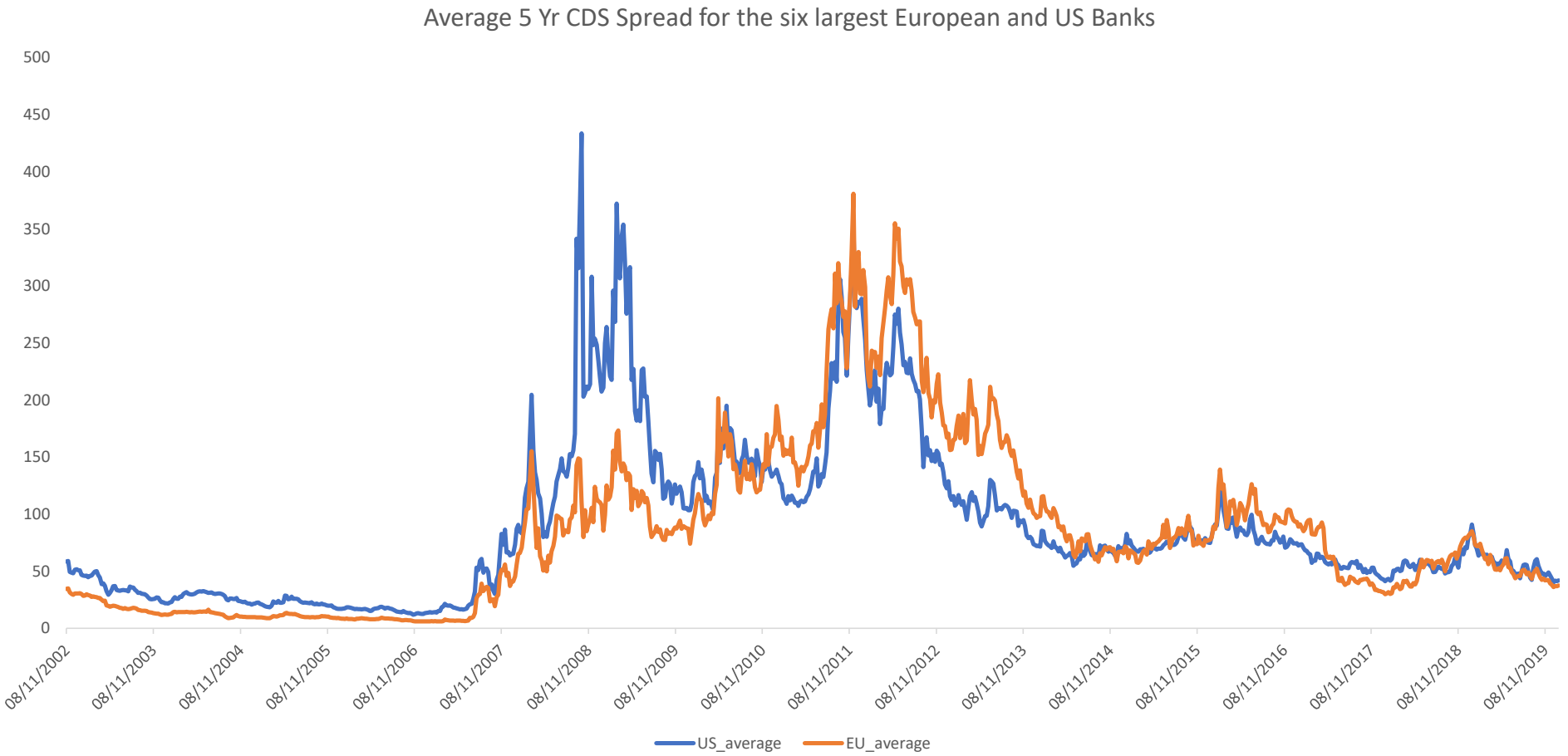
Funding Value Adjustments (FVA)

- FVAs represent compensation for creditors following the bail-in policy (Dodd-Franc Act). This example will clarify it:
- purchases a Treasury security at $100 for one year. Interest rates are zero one-year credit spread is 50bp. The dealer funds in full the asset by writing commercial paper.
- After one year the dealer will receive $100 but she will pay back $100.50 for a total loss of $0.50. This loss will be faced by the shareholders of the bank, under the assumption that the bank survives. Survival probability say 0.95.
- It follows that the net cost for the dealer' shareholder is 0.99*0.50 that is 0.495. This cost is a transfer of wealth from banks' shareholders to unsecured creditors who, in case of default, will have available an additional safe asset.
- For this trade to be profitable to shareholders, the dealer should, purchase the security at $99.51 and sell it at 100.50!

Banks’ Funding Costs 3M LIBOR-OIS



Banks’ CDS Spread



Debt Overhang Costs (DOC)

- DOCs have increased!
- This has affected asset intermediation

Leverage Ratio (LR)

- Non-risk-weighted capital requirements, in the form of the leverage ratio requirement, mandate banks to maintain capital against all assets, regardless of their risk characteristics.
- Even for riskless positions, it still expands the size of bank balance!
- LR also contributes to reduce intermediation

Why Higher Funding Costs?

- The high funding costs post-2008 are only, in part, related to new regulations (LR), most of it is DOCs!
- Two strands of literature to explain balance sheet rigidity.
- First: (Fleckestein et al 2020; Du et al, 2022; Du et al, 2018; Cenedese et al, 2020), banks' balance sheet space correlates, somehow, with banks' leverage ratio (LR)
- Second: (Anderson et al, 2019; Burnside and Cerrato, 2023), debt overhang.

Covered Interest Parity Condition (CIP)

- The cost of borrowing US dollars in wholesale funding markets have been significantly below the rates for synthetic US dollar borrowing (swap market).
- In the absence of trade frictions, the US dollar cost of direct and synthetic should be the same Keynes (1923). But borrowing US$ in the wholesale market is cheaper than synthetic case!
- CIP basis is an exiting arbitrage opportunity but not taken! Why?
- CIP is a case study to study dealers' balance sheet constraints and asset prices (Du et al, 2022; Du et al, 2018; Burnside and Cerrato 2023; Cenedese et al, 2020).

Du et al (2018)

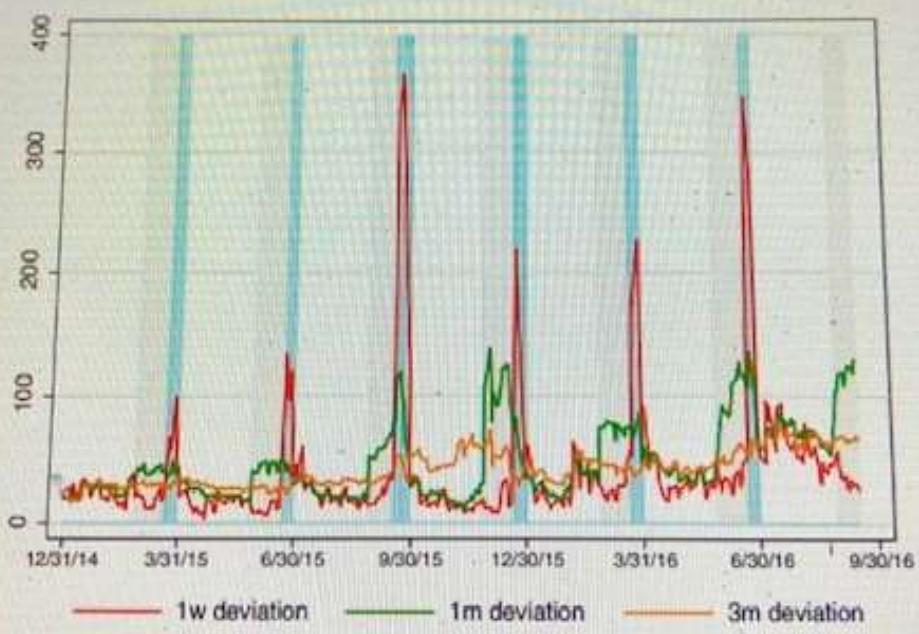


Figure 5. Illustration of quarter-end dynamics of CIP deviations. The blue-shaded area denotes the dates for which the settlement and maturity of a one-week contract spans two quarters. The gray-shaded area denotes the dates for which the settlement and maturity dates of a one-month contract spans two quarters but excludes the dates in the blue-shaded area. The figure plots the one-week, one-month, and three-month Libor CIP deviations for the yen (in absolute values) in red, green, and orange, respectively. (Color figure can be viewed at wileyonlinelibrary.com)

Du et al (2018)

- Note that the quarter-end peaks are also consistent with higher balance sheet rigidity, even with debt overhang.

Burnside and Cerrato (2023)

- Burnside and Cerrato (2023), following Anderson et al (2019), consider debt overhang as a possible explanation for balance sheet constraints.

PERIOD WHEN BANKS ARE NOT SUBJECT TO LR, $\Delta CIP_{it} = a_i + \beta \Delta CDS_t + u_{it}$			
	∆1W-IOER-LIBOR	∆1M-IOER-LIBOR	∆3M-REPO-REPO
	17/10/2008-2/1/2015	17/10/2008-2/1/2015	17/10/2008-2/1/2015
∆CDS	-0.54***	-0.41***	-0.4***
SE	[0.096]	[0.046]	[0.030]
adj-Rquared	0.13	0.08	0.18
∆US-CDS	-0.53***	-0.36***	-0.37***
SE	[0.088]	[0.050]	[0.020]
adj-Rquared	0.14	0.12	0.24
∆EU-CDS	-0.09**	-0.16***	-0.16***
SE	[0.0033]	[0.030]	[0.040]
adj-Rquared	0	0.01	0.05

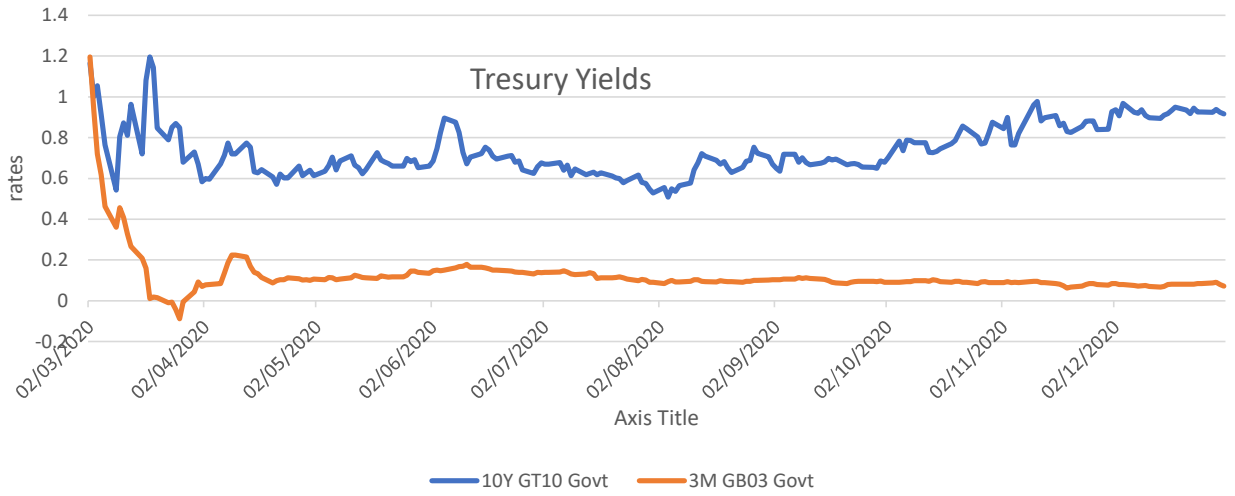
- BC(2023) report sizeable CIP deviations. They test if that can be explained by debt overhang.
- There is more evidence (and in other markets) suggesting that LR is not the only source Fleckenstein and Longstaff (2020).

Implications for Financial Markets

- Dealers' (in)ability to intermediate assets (i.e. provide liquidity cause of debt overhang costs) is creating a pervasive effect on asset prices (in different asset classes) which are yet largely unknown!
- I will provide two examples. The first from He at al, (2022) on US Treasury securities. The second from Bakshi, Cerrato, Ramian and Wang (2023) on fx.
- Still unexplored ground, more research here!

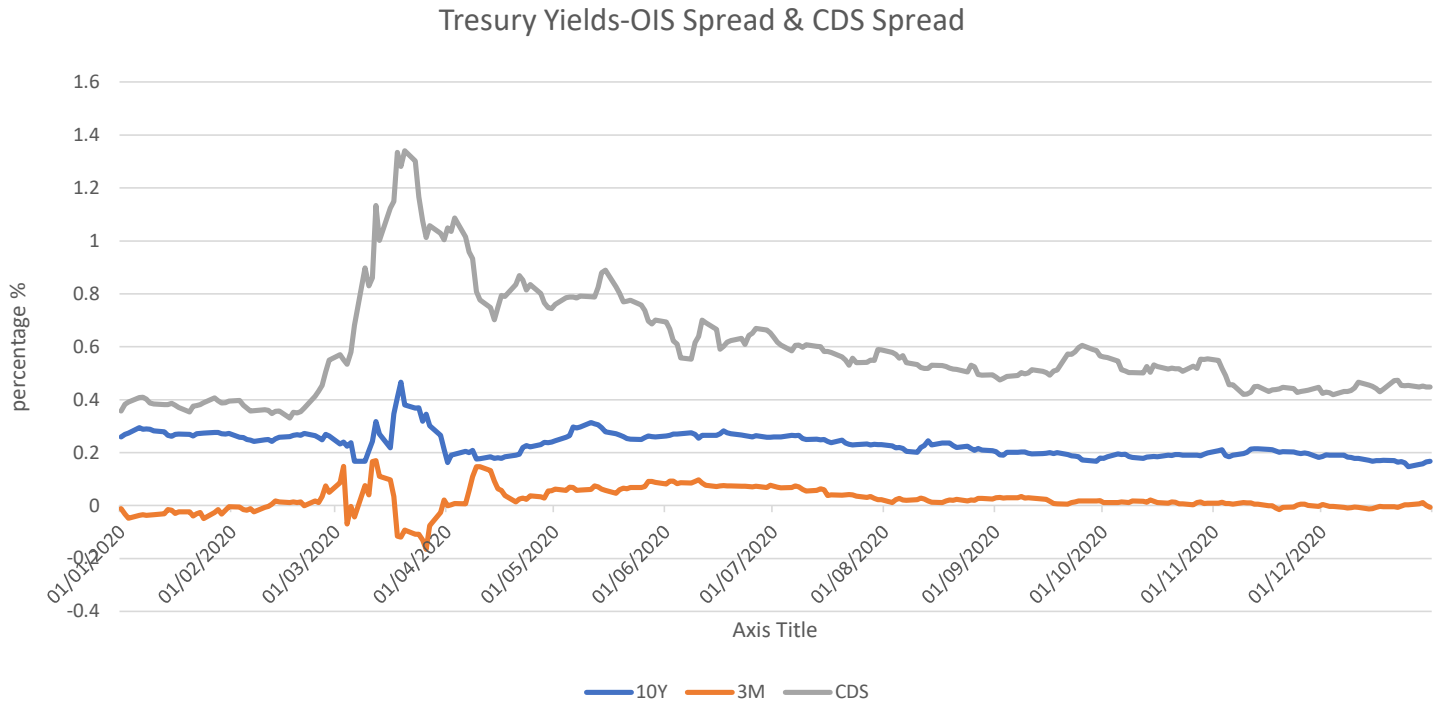
Implications for Financial Markets

- I replicate He at al (2022) pic below to set the problem:



- The model in He et al (2022) suggests that LR can explain the dynamics.
- Why then the 3M Treasury yields decline?

Implications for Financial Markets



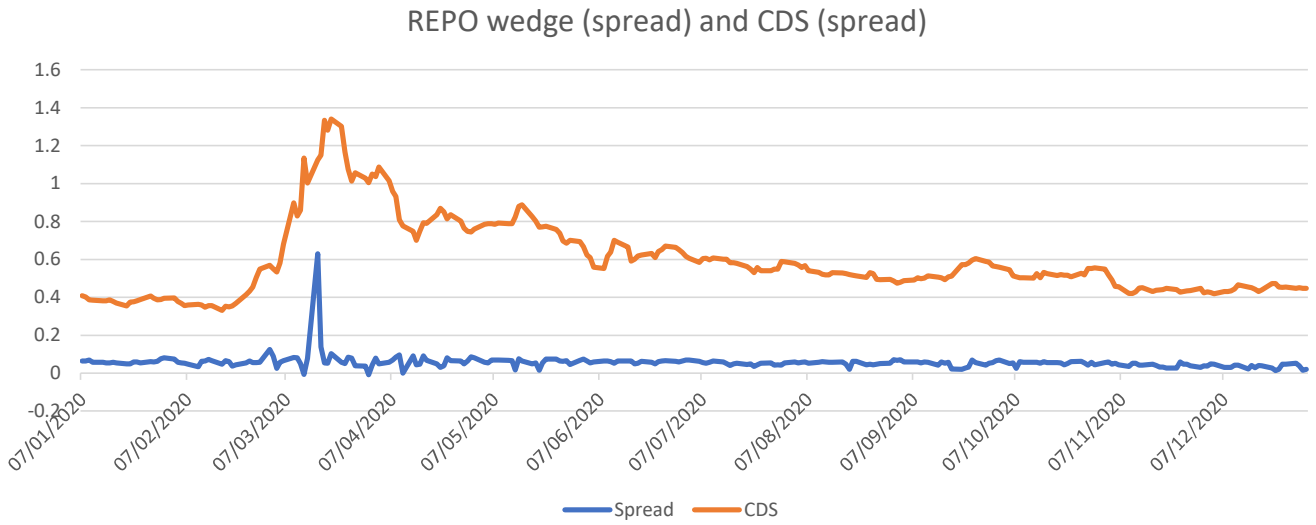
- Following He et al (2022), I constructed their measure of balance sheet constraints due to LR.
- The negative correlation between debt overhang cost and 3M yield spread suggest that dealers are capital constrained and reduce the holdings of long-term securities.
- Copeland et al (2022) suggest that dealers' reserves at FED were not that large due to the FED reducing the balance sheet.

Implications for Financial Markets

- Eventually the FED intervention in middle March purchasing $1 trillion in 3 weeks restored market liquidity.

Implications for Financial Markets

- He et al (2022) model links the Treasury and REPO market. Hedge-funds borrow in the REPO market from the dealer (posting Treasury as collateral). Given that the LR prevents the dealer from supplying REPO funding, this creates a friction which increases the cost at which dealers supply REPO funds (General REPO rates) with respect to their funding rates (tri-party repo), repo wedge (free lunch!).



- Debt overhang appear to be highly correlated with the wedge.

Implications for Financial Markets

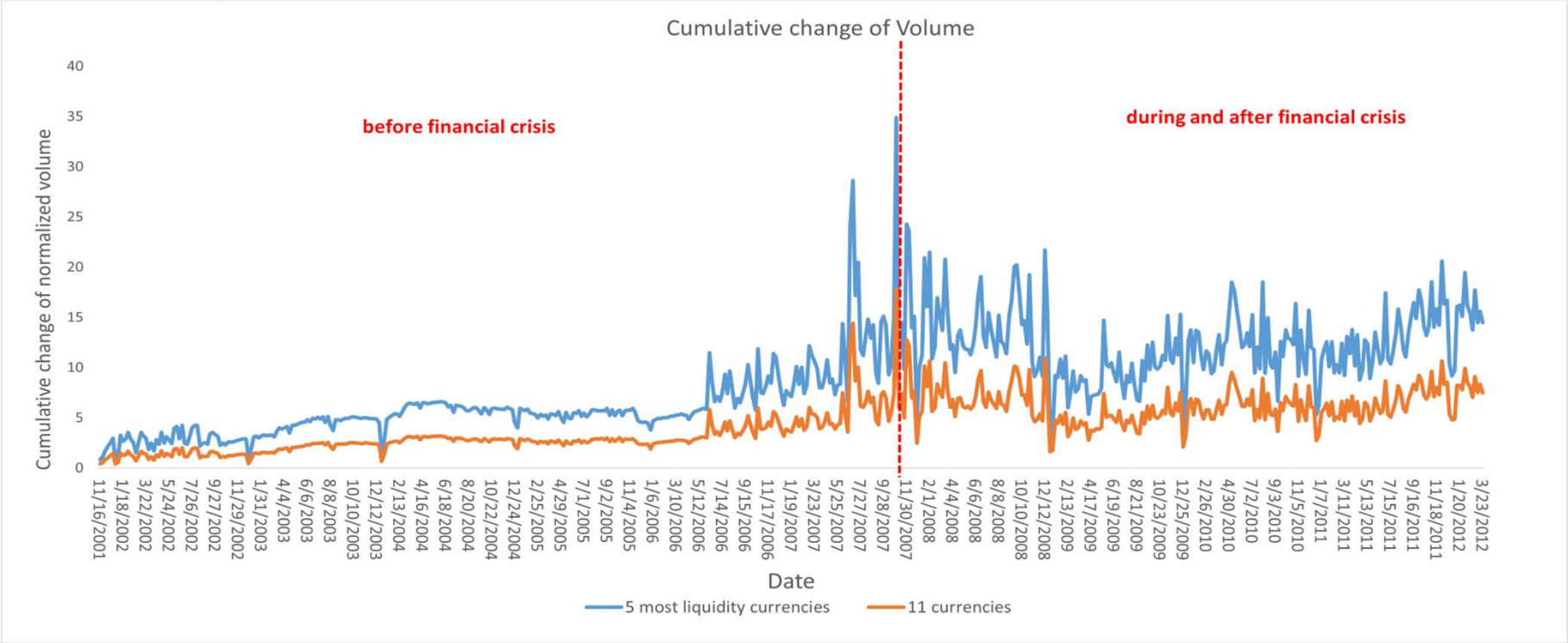
- I tested it by running a simple regression with dummy for March/April 2020

	Δ(10Y Treasury-OIS)	Δ(3M Treasury-ois)		Δ(Wedge)
Variable	Coeff	Coeff		Coeff
Δ(CDS)	-0.02	-0.01	(0.16)	0.02
dummy*Δ(CDS)	0.1	0.04	(-0.02)	-0.01
dummy*Δ(CDS(-1))	0.14*	-0.11*	(-0.30)***	-0.04*
dummy*Δ(CDS(-2))				0.8**
R-sq	0.09	0.02	(0.39)	0.34
No. Obs	260	260	(260)	259
Robust standard errors, from 06/01/2020 to 31/12/2020				
dummy =1 in March/April 2020, zero otherwise; In parenthesis LIBOR minus OIS spread (short maturity) to replace 5 year CDS spread.		$\Delta Treasury_t = a + \beta_1 \Delta CDS_t + \Delta\beta_2 \Delta CDS_{t-1} + u_t$		

Implications for Financial Markets

- The second example is from the fx market.
- Cespa et al (2022) in an important paper suggest that fx volume contains fundamental info which helps to predict currency returns (CLS Group Data, daily 2012-17).
- Czech et al (2022) suggest that option volume is informative (CLS Group Data, daily 2014-16).
- Bakshi, Cerrato, Ramian and Wang (2023) using weekly volume data from a top European dealer, for 11 currencies (6 from G-10) from 2002-2012 point out that:
  - Info in the fx volume is only present after 2008. Why?
  - This info is highly correlated with debt overhang.
- Next pic is from Bakshi, Cerrato, Ramian and Wang (2023).

Implications for Financial Markets



Implications for Financial Markets

- Table below is Bakshi, Cerrato, Ramian and Wang (2023). It shows estimated betas in Cespa et al (2022) conditional on dealer's balance sheet constraint (debt overhang costs)

	CDS percentile	beta
full sample	0	0.3738**
least constrainted	0.2	0.0270
	0.4	0.1589
	0.6	0.4236**
most constrainted	0.8	0.4506***

Implications for Financial Markets: Conclusions

- Dealers' balance sheets constraints (whatever you believe in…LR or debt overhang) are pervasive and are affecting the correct functioning of financial markets across different asset classes! More work in this area.
- Next area which I wish to discuss is about the asset pricing interpretation of balance sheets constraints. I am focusing on debt overhang while Du et al (2021) discuss LR constraints. This is also a new unexplored area!

Implications for Asset Pricing

- He et al (2017) propose an intermediary asset pricing model with two factors: intermediary equity (W_t) to proxy classical shift in productivity affecting fundamentals and intermediary equity capital ratio γ_t

- $$\gamma_t = \frac{\sum_i Market\ Equity_{it}}{\sum_i (Market\ Equity_{it} + Book\ Debt_{it})}$$

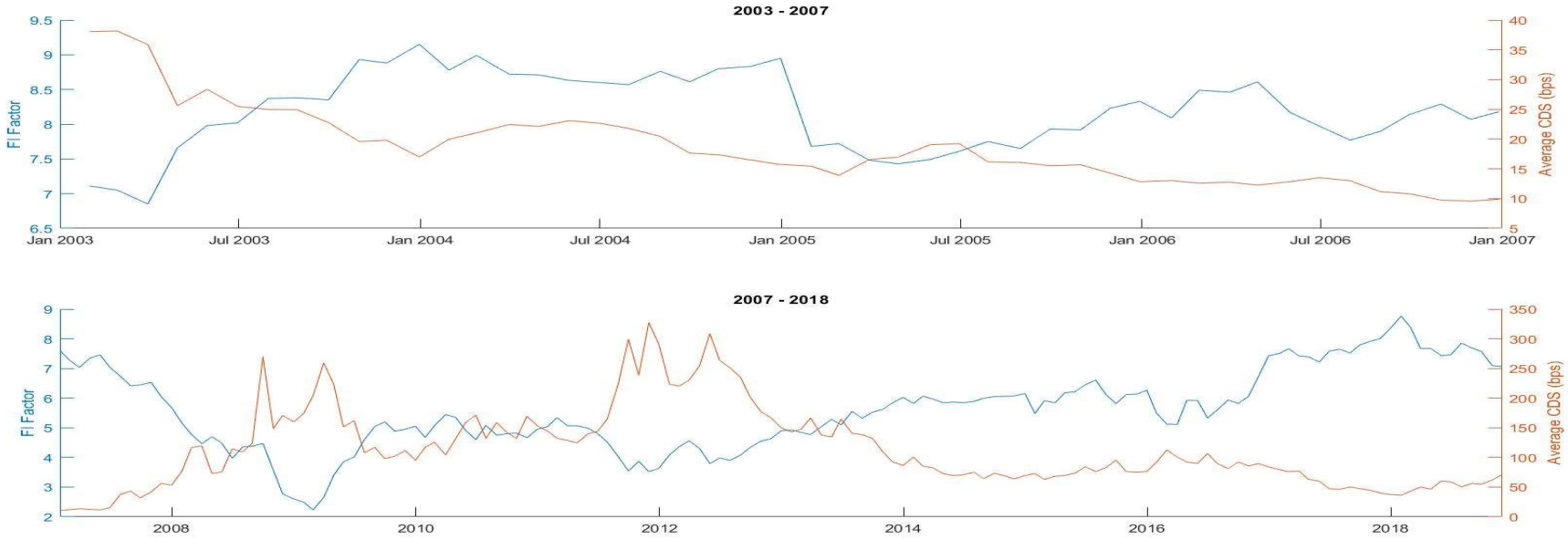
- They assume that the intermediary marginal utility is

$$\Delta_t = e^{-\rho}\ (\beta W_t)^{-\gamma}$$

- This implies that the marginal value of wealth is higher when W is low, linking this directly to the capital.

Implications for Asset Pricing

- More research here, yet unexplored ground!
- I plot the Burnside and Cerrato (2023) pricing factor and equity capital ratio (%) using (updated) monthly data directly from He et al (2017) and CDS (bp).
- Correl. -0.87 (2003-2007); Correl. -0.79 (2008-2018)



Implications for Asset Pricing

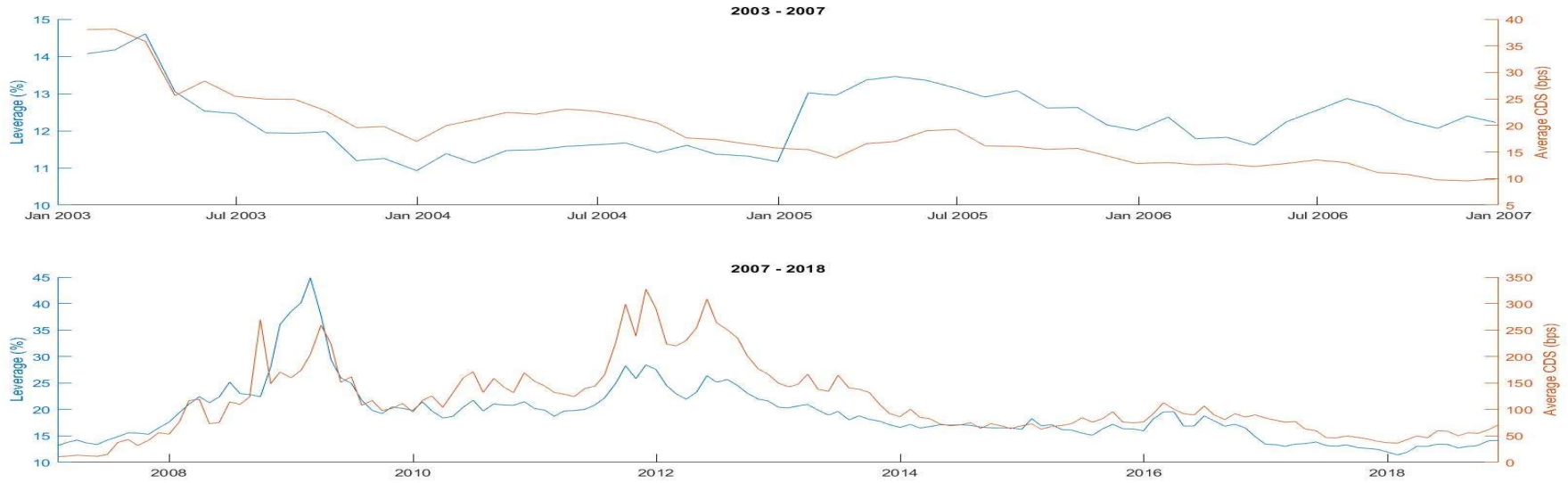
- If credit spread contains relevant info for asset pricing, it should also be informative for the dealer in a way that when it becomes more expensive to hold assets, she will reduce the holdings!

- $\Delta sum(Asset_t) = -0.98 - 0.64^{***}\Delta sum(Asset_{t-1}) + 0.08\Delta CDS_{t-1} - 0.06^{*}\Delta u_t CDS_{t-2} + u_t$

- Debt overhang seems to be a good instrument highly correlated with dealers' balance sheet constraints!

Implications for Asset Pricing

- Adrian et al (2014) consider dealers' leverage.
- In their model leverage increases when intermediary equity is high (marginal value low) and decreases when equity is low (marginal value is high). Corr 0.66 (up to 2007), 0.74 from 2008.



Implications for Asset Pricing

- I employ a similar regression as before where we replace assets with leverage(see Adrian et al, 2014).

- $\Delta sum(\text{Leverage}_t) = -0.11^{***} - 0.79^{***}\Delta sum(leverage_{t-1}) + 0.02^{**}\Delta CDS_{t-2} + u_t$
- $R^2 = 0.69$

- This is consistent with He et al (2017) where leverage increases in “bad times”!

- Cerrato, Ozsoylev and Zhang (2023) propose a novel (intermediary credit spread) pricing factor to reflect these results and show that this factor can price the cross section of a variety of exotic portfolios.

Conclusions

- Post 2008 new frictions relevant to understand market functioning and asset pricing
  - Regulatory: Leverage Ratio
  - Capital structure: debt overhang (FVAs and DVAs)
- They both appear relevant and not mutually exclusive!
- More research on how these frictions affect asset classes and market stability (emerging markets??)
- More research on how to incorporate them into more realistic (OTC) asset pricing models.