An Economist's View on Derivatives and Financial Stability

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Introduction

- Derivatives have been around for a long time. A (successful, uncleared) OTC trade in options executed by Thales of Miletus has been described in great detail in Aristotle's Book I on Politics.

- Derivatives play an obvious role, and booms in innovations follow either the advent of new uncertainties that require protection, or some regulatory relaxations, or both.

- Derivatives contracts that offer no real hedging value to any side are unlikely to be successful on a larger and longer scale (Milgrom-Stokey (1982)), at least as long as people learn.

Optimal Financial Innovations in General Equilibrium

- Derivatives innovations may complete markets and reveal valuable information [e.g. surveys by Allen and Gale (1994), Duffie and Rahi (JET, 1995) and references therein, Ross (QJE, 1976), Duffie and Jackson (RFS, 1989)].

- Fruitful settings are those with natural clientèles where innovated derivatives lead to allocational efficiencies and to Pareto improving outcomes [Shiller (*Macro Markets*, 1993), Acharya and Bisin (JofB, 2006), Gabaix et al. (JofF, 2007), Rahi and Zigrand (RFS, 2008)].

Why General Equilibrium?

- Certainly simple NA mispricing occurred and did not help. But biggest failure was failure to analyze derivatives in a general equilibrium setting to account for all intended and unintended consequences that market forces unleash. **Fallacy of composition.**

- For instance a new single index CDS or a new single index put option can and will change values and dynamics (vols, vols of vols etc.) of the underlying securities, as well as of any other security no matter how unrelated it may appear, due to informational, wealth [e.g. Xiong (JFE, 2001)], dynamic hedging and risk spillovers [liquidity, leverage etc].

- If this crisis episode has done anything, it has refocused research on the general equilibrium effects neglected in the last decade. Also, now that regulation is on people's minds, only general equilibrium thinking can reveal the **true welfare** effects of various regulations.

Mechanism I: Dynamics, Liquidity & Endogenous Risk

- Occasional extreme movements accompanied with big chunks of fresh information: healthy.

- Sometimes markets gather momentum from the endogenous responses of the market participants themselves, rather like a tropical storm or the London Millenium Bridge ["**Endogenous Risk**", Danielsson and Shin (2003)]. Magnified vol purely due to market structure.

- As financial conditions worsen, the willingness of market participants to bear risk seemingly evaporates in response to the deteriorating conditions. They curtail their risk-taking activities by cutting exposures and leverage. The **prudent and conservative actions of one market participant entails negative spillover effects on others** $\Rightarrow$ further declines in the prices of those assets etc. No need for default and dominos.

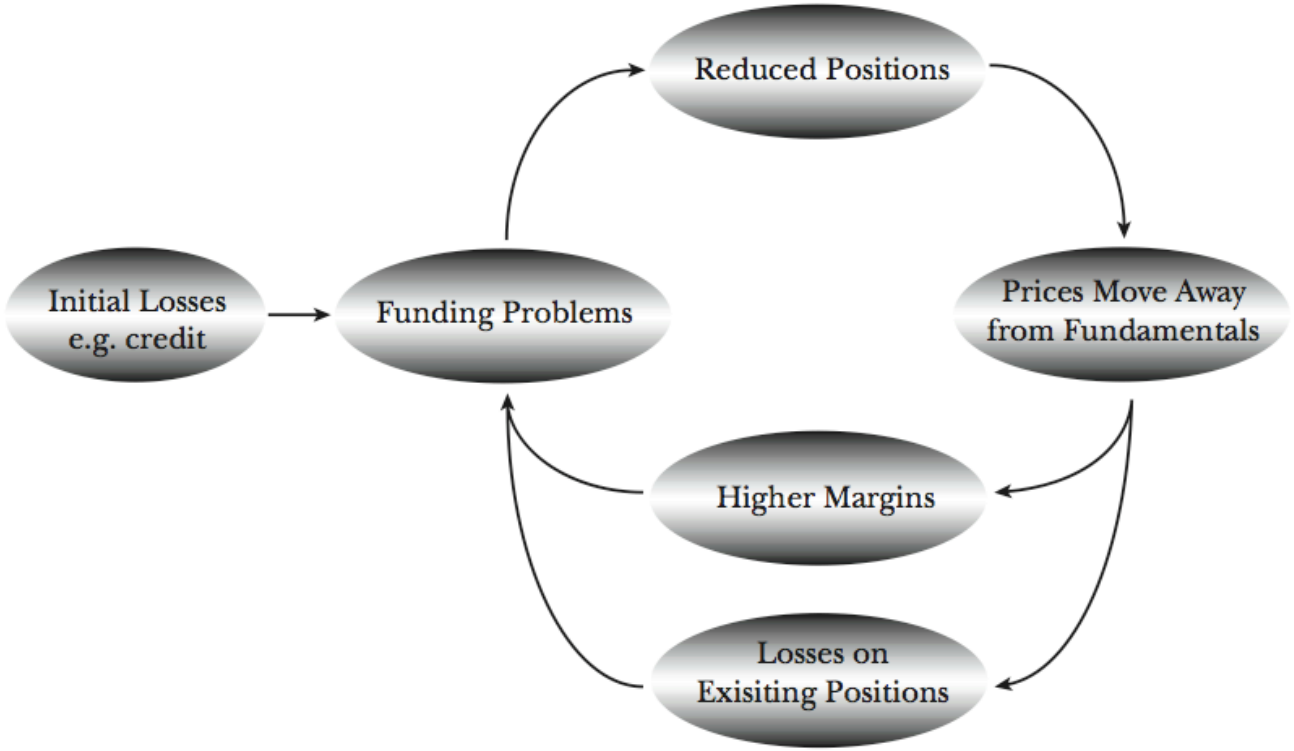
- Endogenous risk is over and above the traditional domino model of contagious default, it captures the **price and leverage spirals** created by the anticipatory and reactive actions of the market participants and the **double-edged nature of prices** (prices as signals and as **imperative** to act) [Brunnermeier and Petersen (RFS, 2009), Danielsson, Shin and Zigrand (2009), Geanakoplos (NBER, 2009), see Shin's "Risk and Liquidity" 2008 Clarendon Lectures in Finance].

- Such spirals are **pro-cyclical** due to risk-sensitive constraints and regulations, time-varying vols, adverse selection and mark-to-market accounting $\Rightarrow$ as if market participants have lost their risk appetite. Extent and the **pro-cyclicality of prices** depend on **leverage** and margins (and on the absolute value of capital).

- Plus: **leverage itself is pro-cyclical**!

Figure 4

The Two Liquidity Spirals: Loss Spiral and Margin Spiral



Source: Brunnermeier and Pedersen (forthcoming).
Note: Funding problems force leveraged investors to unwind their positions causing 1) more losses and 2) higher margins and haircuts, which in turn exacerbate the funding problems and so on.

- **Default** need not occur for these spirals to occur.

  Rather like a Greek tragedy, it is the actions taken by the actors who want to avoid a bad outcome that precipitates disaster.

  So regulating with a view of reducing counterparty risk may be commendable and reduce feedbacks, but will not eliminate the crisis spirals.

- Such situations of **upward sloping equilibrium demands** are well-known in a derivatives context. Typical **example: delta hedging** for portfolio insurance [Gennotte & Leland, (AER, 1990)]. $\exists$ many more such spirals!

- And the higher is the target leverage L maintained by a FI, the steeper is the demand response to price changes (as for a leveraged investor, equity rises L-times faster than total assets).

Mechanism II: Interconnectedness and Liquidity

Interrelated networks can go hand in hand with high leverage amongst banks in boom times to scale balance sheets up, and so systemic risk increases in good times:

1. high counterparty default risk,
2. lack of transparency $\Rightarrow$ more uncertainty
3. highly upward sloping demand ("raise margins just in case"; run)
4. allocational inefficiencies due to pricing differentials (OTC)
5. long intermediation chains, a bloated financial sector, reliance on shorter term credit
6. considerable network externalities
7. imperfect netting
8. amplified cycles [e.g. Allen and Gale (JPE, 2000), Shin (2008), Rahi and Zigrand, "Endogenous Liquidity and Contagion" (2009), Rahi and Zigrand, "Arbitrage Networks" (2009)].

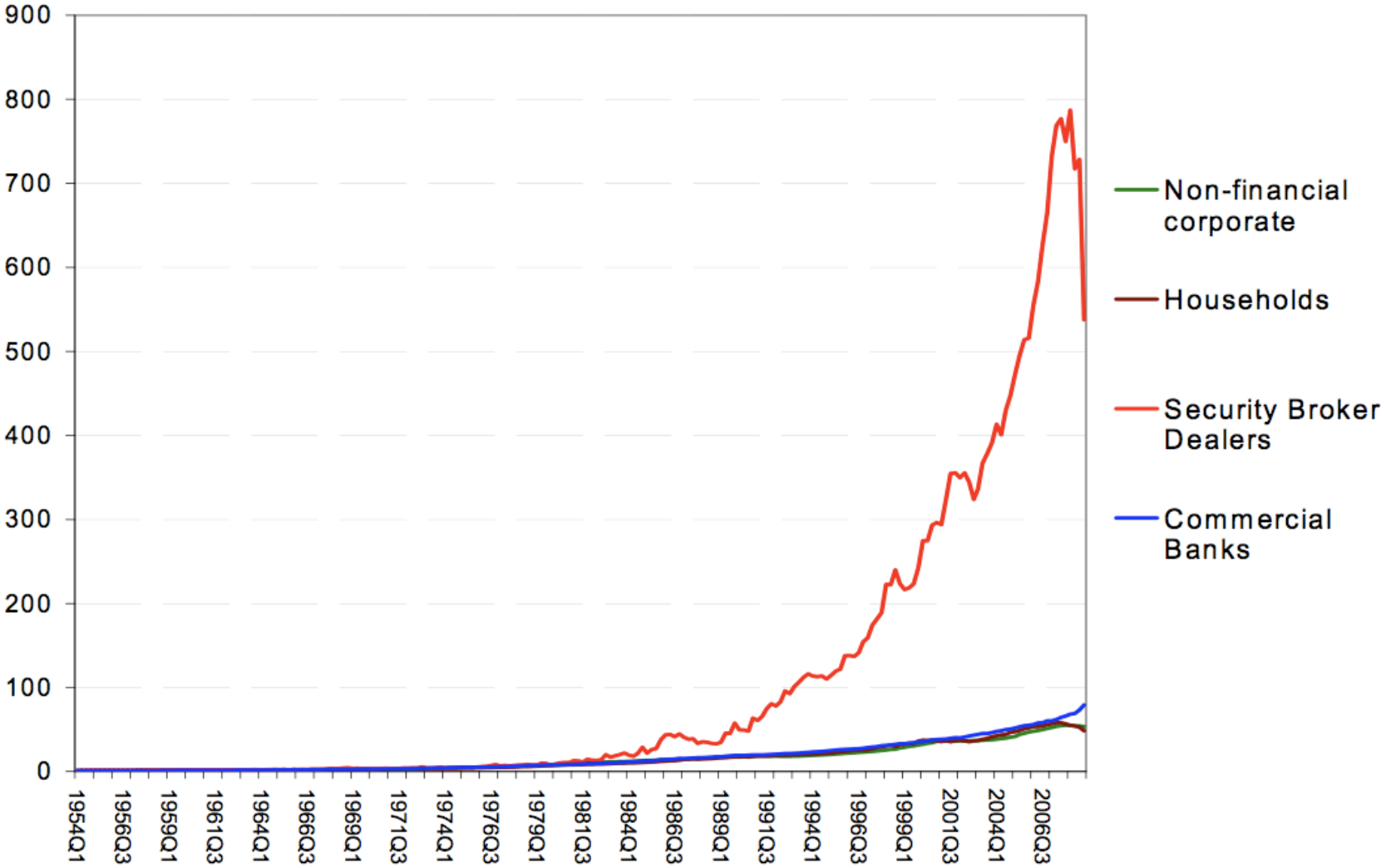
Derivatives join Mechanisms I and II

- The main culprit for the boom-bust cycle is the **underpricing of risk** in the boom phase of the cycle:

  > Andrew Crockett (2000): "risk increases in booms (as leverage and interconnections are formed) and materialises in busts."

  Lower perceived risk & surplus equity $\Rightarrow$ higher leverage of the levered financial institutions and larger balance sheets.

- Derivatives happened to be a useful and convenient tool to achieve this as they allow banks to quickly reach a desired leverage ratio. Derivatives (& securitization) may be one of the major reasons why the **securities sector grew** in size roughly ten times more than any other sector.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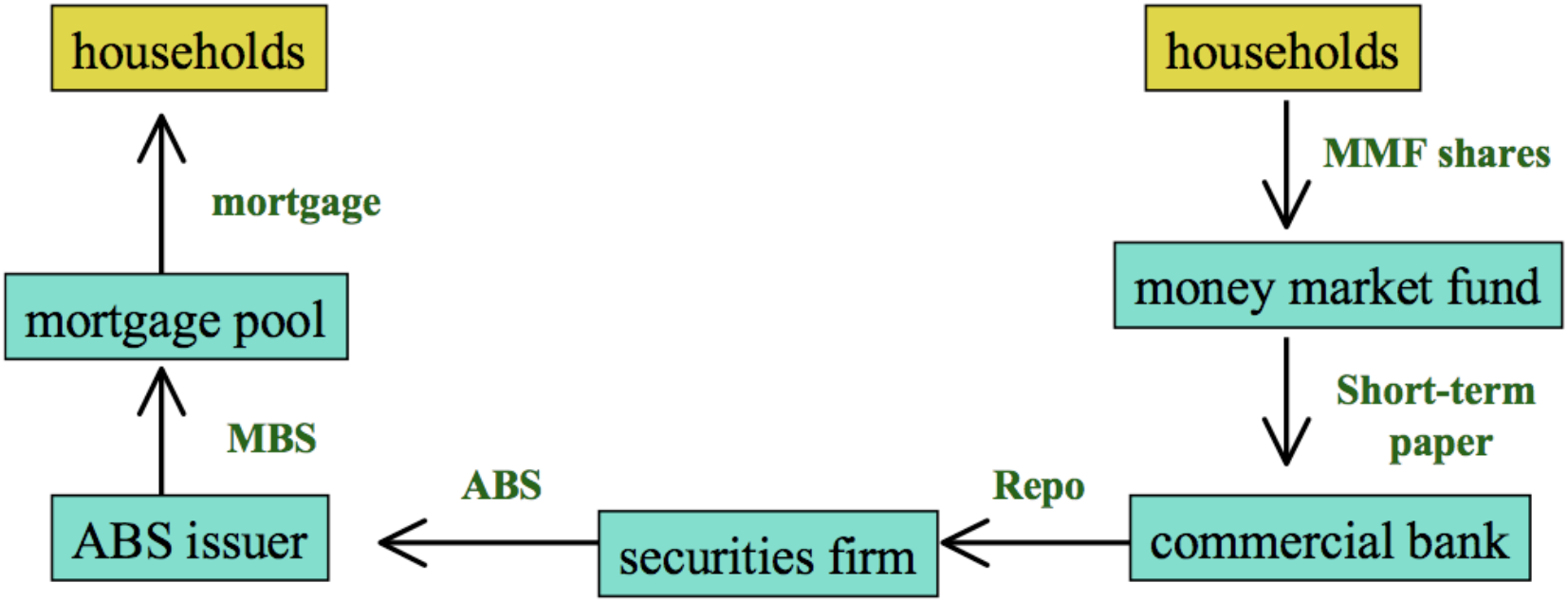
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MMF shares
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- **Equity side**: By reducing (e.g. CDS, or gaming VaR) the risk-weighted capital required $\Rightarrow$ spare capital $\Rightarrow$ allowing an expansion of the total balance sheet (rather than returning capital to share holders) and of leverage given a desired debt-equity ratio.

- **Inside**: Given sluggish new outside debt from end-users, aggregate balance sheets can grow only by the banks lending and borrowing more **from each other** (longer intermediation chains, more interrelated balance sheets, larger securities sector). Many derivatives have leverage built in and allow FIs to grow balance sheets.

- **Outside.** *Asset side*: This raises the aggregate lending to end-users $\Rightarrow$ new end-users need to be found (e.g. lower lending standards, subprime). *Debt side*: In aggregate to outsiders, through derivatives and securitization, this debt can be raised from outside the banking or financial sector (e.g. securitization, SIVs, issuing liabilities against bad loans, short term ABCP held by mmfs, . . .).

- In turn the increased lending to outsiders implies more buoyant macro conditions, in turn leading to lower perceived risks, and the circle closes.

- Lower lending standards, higher leverage by FIs, more interrelatedness $\Rightarrow$ the seeds are sown for the next downturn.
  Corollary: Regulations need to bind in booms more than in busts.

- When the downturn arrives, the bad loans are either sitting on the balance sheets of the large financial intermediaries, or they are in SPVs sponsored by them. This is so, since the bad loans were taken on precisely in order to utilise the slack on their balance sheets and to arbitrage tranches. So derivatives turned out to **concentrate risk** in institutions through products (CDOs etc) designed exactly to pass on the risk to diversified final investors.

CCPs (CCHs)

- To the extent that the spirals are magnified by
  (i) uncertainty of counterparty exposures (and net. structure not CK),
  (ii) the possibly imperfect netting in non-centrally cleared OTC markets,

  CCPs may reduce the spiralling effects in network-style OTC derivative markets, but exact form may matter [e.g. example in Brunnermeier (JEPersp., 2009), Duffie and Zhu (2009)]. They also improve allocational efficiency (through CCP data repository). Cross-CCP netting?

- But since risk-sensitive constraints, marking-to-market and the double-edged nature of prices are still present, the cycles and spirals will not disappear just by having CCPs, even w. perfect netting. Indeed pro-cyclical marking-to-market & settlement are institutionalized in CCPs and exchanges, and going to CCPs from OTC may not decrease pro-cyclicality and liquidity risk (but possibly counterparty risk).

- Ideally, counteracting counter-cyclical mechanisms would have to be found. A welfare analysis of such mechanisms is greatly needed, and much more work needs to be done [But see Acharya et al. "Restoring Financial Stability" (2009) and Brunnermeier et al. "The Fundamental Principles of Financial Regulation, Geneva Report" (2009)].

- In as far as derivatives and systemic risk is concerned, it sounds plausible to require larger initial margins, collateral and mtm from systemically (individually or as part of a herd, mainly highly levered) more important institutions, everything else equal. But hard to implement (give example).

- Not obvious in an equilibrium theory sense, but implementable empirically as per the purely statistical tail-dependency measures in Adrian and Brunnermeier, "CoVaR", 2009. This captures some of the historical **tail inter-relatedness**. But again risk of procyclicality.