When Micro Prudence increases Macro Risk: The Destabilizing Effects of Financial Innovation, Leverage, and Diversification

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joint work with

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In most standard economic models, financial institutions (FIs) are viewed as passive players and credit does not have any macroeconomic effect.

Yet, recent empirical work found: accelerations in credit supply (bank assets) is the key antecedent to financial crises (e.g. Schularick and Taylor 2012)

These empirical results confirm that balance sheet dynamics of FIs, is the “endogenous engine” driving the boom-bust cycles and hence systemic risk.

Adrian Shin (2010) quote: “balance sheet aggregates such as total assets and leverage are the relevant financial intermediary variables to incorporate into macroeconomic analysis"
Balance Sheet expansion of FIs

from Adrian and Shin (2010)

Note: Shadow banks are ABS issuers, finance companies, and funding corporation
Source: Board of Governors of the Federal Reserve
Related literature

Our paper tries to combine several strands of literature:

- on the impact of capital requirements on the behavior of FIs (Danielsson et al., 2004, 2009; Adrian & Shin, 2009; Adrian et al., 2011);

- on the effects of diversification and overlapping portfolios on systemic risk (Tasca & Battiston, 2012; Caccioli et al., 2012)

- on the risks of financial innovation (Brock et al. 2009, Haldane & May, 2011)

- on distressed selling and its impact on the market price dynamics (Kyle & Xiong, 2001; Cont & Wagalath, 2011, Thurner et al., 2012; Caccioli et al., 2012)

- on the determinants of balance sheet dynamics of FIs and credit supply (Stein 1998; Bernanke & Gertler 1989; Bernanke, Gertler, & Gilchrist, 1996, 1999; Kiyotaki & Moore, 1997)

Contribution: propose a simple model that, by combining these different streams of literature, provides full analytical quantification of the links between micro prudential rules and macro prudential outcomes.
We try to keep behavioral assumptions at minimum, exploiting instead the implications of *objective factors in balance sheet dynamics* such as:

- *mark-to-market* accounting rules,
- **VaR constraints** arising from
  - regulatory capital requirements (Basel I, II)
  - margin on repos (Brunnermaier and Pedersen 2008)
  - rating agencies
  - internal risk management models

We then start from a simple portfolio optimization problem in presence of cost of diversification and VaR constraints
The portfolio choice

- For simplicity, we assume that FIs adopt a simple investment strategy: equally weighted portfolio of $m$ randomly selected investment (out of $M$)

- we consider the existence of "costs of diversification" $c$ reflecting the presence of transaction costs, firms specialization and other types of frictions.

- With $r_L$ the avg interest rate on liabilities the portfolio expected return is $\mu - r_L$,

- FI maximizes portfolio returns under VaR constraints.

\[
VaR = \alpha \sigma_p A \leq E.
\]

with $\sigma_p$ the holding period volatility, $A$ asset of bank $i$, and $\alpha$ a constant,
The investment set:

- collection of risky investment \( j = 1, \ldots, M \)

- FIs, correctly perceive that each risky investment entails both an idiosyncratic (diversifiable) risk component and a systematic (undiversifiable) risk component,

\[
\sigma_i^2 = \sigma_s^2 + \sigma_d^2
\]

where

- \( \sigma_s^2 \) is the systematic risk
- \( \sigma_d^2 \) is the diversifiable risk component.

Hence, the expected mean and volatility per dollar invested in the portfolio chosen by a given institution are \( \mu \) and

\[
\sigma_p = \sqrt{\sigma_s^2 + \frac{\sigma_d^2}{m}}
\]
The portfolio optimization

Then, facing cost of diversification and VaR constraints, FI chooses the total asset $A$ ($E$ is sticky) and diversification $m$ which max their portfolio returns.

$$\max_{A,m} A(\mu - r_L) - \tilde{c}m \quad \text{s.t.} \quad \alpha A \sqrt{\sigma_s^2 + \frac{\sigma_d^2}{m}} \leq E.$$ 

Dividing by $E$ and with $c = \frac{\tilde{c}}{E}$, the max can be written in terms of the leverage $\lambda = \frac{A}{E}$,

$$\max_{\lambda,m} \lambda(\mu - r_L) - cm \quad \text{s.t.} \quad \alpha \lambda \sqrt{\sigma_s^2 + \frac{\sigma_d^2}{m}} \leq 1.$$ 

→ chooses the optimal leverage $\lambda^* = \frac{A^*}{E}$ and $m^*$ which max ROE under the VaR

Squaring the constraint the Lagrangian can be written as

$$L = \lambda(\mu - r_L) - cm - \frac{1}{2} \gamma \left( \alpha^2 \lambda^2 \left( \sigma_s^2 + \frac{\sigma_d^2}{m} \right) - 1 \right).$$ 

where $\gamma$ is the Lagrange multiplier for the VaR constraint.
Optimal leverage and diversification

F.O.C. \[ \Rightarrow \quad \lambda^* = \frac{1}{\gamma} \frac{1}{\alpha^2} \frac{\mu - r_L}{\sigma_p^2} \]

with Lagrange multiplier \[ \gamma = \frac{1}{\alpha} \frac{\mu - r_L}{\sigma_p} \]

- The optimal leverage is

\[ \lambda^* = \frac{1}{\alpha \sqrt{\sigma_s^2 + \frac{\sigma_d^2}{m}}} = \frac{1}{\alpha \sigma_p} \]

- The optimal level of diversification is

\[ m^* = \frac{\sqrt{\gamma \alpha \lambda \sigma_d}}{\sqrt{2c}} = \lambda \sigma_d \sqrt{\frac{\alpha}{2c} \frac{\mu - r_L}{\sigma_p}} \]

Bottom line:

- leverage \( \lambda \) is an inverse function of the portfolio volatility \( \sigma_p \)

- portfolio size \( m \) is an inverse function of diversification costs \( c \)
Diversification cost and optimal leverage

parameters are: $M = 20$, $\alpha = 0.05$, $\mu - r_L = 0.8$, $\sigma_d = 1$.

We then choose $\sigma_s$ equal to 0 (solid line), 0.3 (dashed line), and 0.6 (dotted line).
Diversification cost and portfolio overlap

parameters are: $M = 20$, $\alpha = 0.05$, $\mu - r_L = 0.8$, $\sigma_d = 1$. We then choose $\sigma_s$ equal to 0 (solid line), 0.3 (dashed line), and 0.6 (dotted line).
Leverage targeting and balance sheet adjustments

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Initial position: 
- Assets: 100
- Liabilities: Debt 90, Equity 10

Asset growth: 
- Assets: 101
- Liabilities: Debt 90, Equity 11

Leverage adjustment: 
- Assets: 110
- Liabilities: Debt 99, Equity 11

Increase in value of securities
Increase in equity

From Adrian and Shin (2010)
Balance sheet adjustments: empirical evidence

from Adrian, Colla, and Shin (2010)
Dynamics of asset with portfolio rebalancing

At the beginning of each investment period FIs rebalance their portfolio by the difference between the desired amount of asset \( A_{j,t}^* = \lambda E_{j,t} \) and the actual one \( A_{j,t} \)

\[
\Delta R_{j,t} \equiv A_{j,t}^* - A_{j,t} = \lambda E_{j,t} - A_{j,t},
\]

By defining realized portfolio return \( r_{j,t}^p \), can be rewritten as

\[
\Delta R_{j,t} = (\lambda - 1)r_{j,t}^p A_{j,t-1}^* - 1
\]

\( \Rightarrow \) any P&L from the investments portfolio \( r_{j,t}^p A_{j,t-1}^* \) results in a change of FI asset value amplified by the target leverage (for \( \lambda > 1 \)).

\( \Rightarrow \) VaR induces a perverse demand function: buy if \( r_{j,t}^p > 0 \), sell if \( r_{j,t}^p < 0 \)

\( \Rightarrow \) positive feedback
Dynamics of investments demand

The aggregate demand of asset $i$ will be simply the sum of the individual demands of the FIs who picked asset $i$ in their portfolio.

$$D_{i,t} = \sum_{j=1}^{N} I\{i \in j\} \frac{1}{m} \Delta R_{j,t} \approx \sum_{j=1}^{N} I\{i \in j\} (\lambda - 1) r_{j,t} A_{j,t-1}^{*}$$

where $I\{i \in j\}$ is 1 if asset $i$ is in the portfolio of institution $j$ and zero otherwise.

Considering total assets approximately the same across FIs, $A_{j,t-1}^{*} \approx A_{t-1}^{*}$, demand of investment $i$ can be approximated as

$$D_{i,t} \approx (\lambda - 1) \frac{A_{t-1}^{*}}{m} \frac{N}{M} \left( r_{i,t} + \frac{m-1}{M-1} \sum_{k \neq i} r_{k,t} \right)$$

Note: it can be shown that demand correlation between two assets $\rho(D_i, D_k) \rightarrow 1$
Parameters are $M = 20$, $N = 100$, and $\sigma_d = 1$.
We then choose $\sigma_s$ equal to 0 (solid line), 0.3 (dashed line), and 0.6 (dotted line).
With rebalancing feedbacks, the return process is now made of 2 components:

\[ r_{i,t} = e_{i,t-1} + \varepsilon_{i,t} \]

endogenous

exogenous

We assume that the exogenous component has a multivariate factor structure:

\[ \varepsilon_{i,t} = f_t + \epsilon_{i,t} \]

factor

idiosyncratic

uncorrelated and distributed with mean 0 and constant volatility, \( \sigma_f \) and \( \sigma_\epsilon \) (the same for all investments).

Thus, the variance of the exogenous component of the risky investment \( i \) is:

\[ V(\varepsilon_i) = \sigma_f^2 + \sigma_\epsilon^2 \]
Assuming a linear price impact function the endogenous component becomes

$$e_{i,t} = \frac{D_{i,t}}{\gamma_i C_{i,t}}$$

where

- $\gamma_i$ is the market liquidity of asset $i$
- $C_{i,t} = \sum_{j=1}^{N} I_{\{i \in j\}} \frac{A_{j,i,t-1}}{m} \approx \frac{N}{M} A_{i,t-1}^*$ is a proxy for market cap

Substituting $D, r, \text{ and } C$, we obtain the following VAR(1) for $e_t$

$$e_t = \Phi (e_{t-1} + \varepsilon_t)$$

where $\Phi \equiv (\lambda - 1) \Gamma^{-1} \Psi$ with

$$\Gamma_{M \times M} = \begin{bmatrix}
\gamma_1 & 0 & \ldots & 0 \\
0 & \gamma_2 & \ldots & 0 \\
\vdots & \vdots & \ddots & \vdots \\
0 & 0 & \ldots & \gamma_M \\
\end{bmatrix}, \quad \Psi_{M \times M} = \begin{bmatrix}
\frac{1}{m} & \frac{1}{m-1} & \ldots & \frac{1}{m-1} \\
\frac{1}{m} & \frac{1}{m-1} & \ldots & \frac{1}{m-1} \\
\frac{1}{m} & \frac{1}{m-1} & \ldots & \frac{1}{m-1} \\
\frac{1}{m} & \frac{1}{m} & \ldots & \frac{1}{m} \\
\end{bmatrix}.$$
The VAR(1) dynamics

\[ e_t = \Phi (e_{t-1} + \varepsilon_t) \]

is dictated by the eigenvalues of the matrix

\[ \Phi \equiv (\lambda - 1) \Gamma^{-1} \Psi. \]

Being the max eigenvalue of \( \Psi \) equal 1 \( \forall m \), we have:

\[ \Lambda_{\text{max}} \approx (\lambda - 1) \bar{\gamma}^{-1} \]

where \( \bar{\gamma}^{-1} \) is the average of all the \( \gamma_i^{-1} \).

\( \Rightarrow \) the max eig depends on leverage and on the average illiquidity of the assets.

When \( \Lambda_{\text{max}} > 1 \), the return processes become non-stationary and explosive.
parameters are: $M = 20$, $\alpha = 0.05$, $\mu - r_L = 0.8$, $\gamma = 40$, and $\sigma_d = 1$. We then choose $\sigma_s$ equal to 0 (solid line), 0.3 (dashed line), and 0.6 (dotted line). The horizontal solid line shows the condition $\Lambda_{\text{max}} = 1$, ...
We can write,

\[
m\Psi = \begin{bmatrix}
1 & \frac{m-1}{M-1} & \cdots & \frac{m-1}{M-1} \\
\frac{m-1}{M-1} & 1 & \cdots & \frac{m-1}{M-1} \\
\vdots & \ddots & \ddots & \vdots \\
\frac{m-1}{M-1} & \frac{m-1}{M-1} & \cdots & 1
\end{bmatrix} = (1 - b)I + bu',
\]

with \( b = \frac{m - 1}{M - 1} \).

Thus, the endogenous component of an individual investment \( i \) becomes

\[
e_{i,t} = (1 - b) a_i (e_{i,t-1} + \varepsilon_{i,t}) + b Ma_i (\bar{e}_{t-1} + \bar{\varepsilon}_t)
\]

with \( a_i = \frac{\lambda - 1}{m \gamma_i} \).

Moreover, assuming all investments have the same liquidity, we can show:

- the average process \( \bar{e}_t \) is an AR(1) (systemic component)
- the distance from the avg \( \Delta e_{i,t} \equiv e_{i,t} - \bar{e}_t \) is an AR(1) (idiosyncratic)

\( \Rightarrow \) the endogenous return dynamics can be seen as a multivariate "ARs around AR"
Endogenous Variance & Covariance formulas

Thanks to this representation we can explicitly compute the variance and covariances of endogenous components $e_{i,t}$

\[
V(e_{i,t}) = \frac{(\lambda - 1)^2 m^2 (\sigma_i^2 (\lambda - 1)^2 - \gamma^2 (M-1)^2) + \sigma_i^2 (\lambda - 1)^2 - \gamma^2 (M-1)^2) + 2m(M(\sigma_i^2 (\lambda - 1)^2 - \gamma^2 (M-1)^2) + \gamma^2 \sigma_i^2) + M(\sigma_i^2 (\lambda - 1)^2 - \gamma^2 (M-1)^2) + (\lambda - 1)^2 \sigma_i^2 + \gamma^2 \sigma_i^2)}{(\gamma^2 - (\lambda - 1)^2)(m^2 (\gamma^2 (M-1)^2 - (\lambda - 1)^2) + 2(\lambda - 1)^2 m M - (\lambda - 1)^2 M^2)}
\]

\[
Cov(e_{i,t}, e_{j,t}) = -\frac{(\lambda - 1)^2 (m^2 (\sigma_j^2 (\lambda - 1)^2 - \gamma^2 (M-1)^2) - \gamma^2 (M-2) \sigma_i^2) - 2m (\lambda - 1)^2 M \sigma_j^2 + \gamma^2 \sigma_j^2) + M (\lambda - 1)^2 M \sigma_j^2 + \gamma^2 \sigma_j^2)}{(\gamma^2 - (\lambda - 1)^2)(m^2 (\gamma^2 (M-1)^2 - (\lambda - 1)^2) + 2(\lambda - 1)^2 m M - (\lambda - 1)^2 M^2)}
\]

and show that:

- $\uparrow$ leverage $\rightarrow$ $\uparrow$ both var and cov of $e_{i,t}$
- $\uparrow$ diversification $\rightarrow$ $\downarrow$ var and $\uparrow$ cov
- Both $\rightarrow$ $\uparrow$ correlations
- $\text{Corr}(e_{i,t}, e_{j,t}) \xrightarrow{m \to M} 1$
Return Var-Cov with rebalancing feedbacks

The feedback induced by portfolio rebalancing, introduces a new endogenous component in the variances and covariances of individual and portfolio returns

- **individual returns:**
  \[
  V(r_{i,t}) = V(e_{i,t}) + V(\varepsilon_{i,t})
  \]
  with \(V(\varepsilon_{i,t}) = \sigma_f^2 + \sigma_\epsilon^2\)

  \[
  \text{Cov}(r_{i,t}, r_{j,t}) = \text{Cov}(e_{i,t}, e_{j,t}) + \sigma_f^2
  \]
  with \(\text{Cov}(e_{i,t}, e_{j,t}) = \sigma_{f}^2 + \sigma_{\epsilon}^2 m\)

- **portfolio returns:**
  \[
  V(r_{p,t}) = \frac{V(e_{i,t})}{m} + \frac{m - 1}{m} \text{Cov}(e_{i,t}, e_{j,t}) + \sigma_f^2 + \frac{\sigma_\epsilon^2}{m}
  \]
  with \(V(\varepsilon_{M,t}) = \sigma_f^2 + \frac{\sigma_\epsilon^2}{M}\)

  \[
  \text{Cov}(r_{h,t}, r_{k,t}) = \frac{V(\bar{e})}{m} + \frac{1}{m} \text{Cov}(\varepsilon_{M,t})
  \]
  with \(\text{Cov}(\varepsilon_{M,t}) = \sigma_f^2 + \frac{\sigma_\epsilon^2}{M}\)

  \[
  V(r_{M,t}) = \frac{1}{1 - \Lambda_{\text{max}}^2} V(\varepsilon_{M,t})
  \]
  “variance multiplier”
Parameters are: $M = 20$, $\alpha = 0.05$, $\mu - r_L = 0.8$, $\gamma = 40$, and $\sigma_d = 1$. We then choose $\sigma_s$ equal to 0 (solid line), 0.3 (dashed line), and 0.6 (dotted line).
Bank asset dynamics

The dynamics of the rebalanced bank asset $A_{j,t}^*$, can be written as

$$A_{j,t}^* = \lambda E_{j,t} = \lambda (E_{j,t-1} + r_{j,t}^p A_{j,t-1}^*) = A_{j,t-1}^* + \lambda r_{j,t}^p A_{j,t-1}^*$$

thus, the relative change of the bank $i$ total asset $r_{i,t}^A$ is simply given as

$$r_{j,t}^A \equiv \frac{A_{j,t}^* - A_{j,t-1}^*}{A_{j,t-1}^*} = \lambda r_{j,t}^p.$$  

Therefore, the var-cov of the relative change of bank assets $r_{j,t}^A$ are simply

$$V(r_{j,t}^A) = \lambda^2 V(r_{j,t}^p) \quad \text{Cov}(r_{h,t}^A, r_{k,t}^A) = \lambda^2 \text{Cov}(r_{h,t}^p, r_{k,t}^p),$$

We can finally compute the variance of the total asset of the whole banking sector

$$V\left(\sum_{j=1}^{N} r_{j,t}^A\right) = \lambda^2 V\left(\sum_{j=1}^{N} r_{j,t}^p\right)$$

with

$$V\left(\sum_{j=1}^{N} r_{j,t}^p\right) \xrightarrow{m \to M} \frac{N^2 V(\varepsilon_{M,t})}{1 - \Lambda_{\text{max}}}.$$
parameters are: $M = 20$, $\alpha = 0.05$, $\mu - r_L = 0.8$, $\gamma = 40$, $\sigma_d = 1$, and $N = 100$. We then choose $\sigma_s$ equal to 0 (solid line), 0.3 (dashed line), and 0.6 (dotted line). The vertical lines indicate where the variance of total asset diverges.
We can show that correlation between FI portfolio returns $\rho_p \xrightarrow{m \to M} 1$

The total systematic (exogenous and endogenous) component is $s_t = \bar{e}_t + f_t$. The portfolio return distribution conditioned on a systematic shock $s_t^{\text{shock}}$ is

$$r_{i,t}^p | s_t^{\text{shock}} \sim N \left( s_t^{\text{shock}}, \frac{\sigma_d^2}{m} \right).$$

$\Rightarrow$ probability of default of a FI given a systematic shock $s_t^{\text{shock}}$ is

$$PD_{i,t-1} = P \left( [r_{i,t}^p | s_t^{\text{shock}}] \leq -\alpha \sqrt{\sigma_s^2 + \frac{\sigma_d^2}{m}} \right)$$

$$= \Phi \left( \frac{-\alpha \sqrt{\sigma_s^2 + \frac{\sigma_d^2}{m}} - s_t^{\text{shock}}}{\sqrt{\frac{\sigma_d^2}{m}}} \right) \xrightarrow{m \to M, M \to \infty} 1 \quad \forall \ s_t^{\text{shock}} < -\alpha \sigma_s,$$

$\Rightarrow$ robust yet fragile behavior emerges

Bottom line: diversification tends to increase the probability of a systemwide failures.
If endogenous components is not accounted for ⇒ underestimation of risk, ⇒ under capitalization of the banking sector ⇒ higher system fragility.

the practice of estimating var-cov of risky assets from past data, automatically considers both the exogenous and endogenous components.

However, var-cov now depend on the level of diversification and leverage:

- in periods $\uparrow$ leverage ⇒ historical volatility underestimate future risk
- in periods $\downarrow$ leverage ⇒ historical volatility overestimate future risk

→ theoretical support for countercyclical capital requirements

Finally, a negative realization of the factor $f_t$, now triggers a sequence of portfolio rebalances causing the price of all risky assets to decay for several periods.

Being

$$r_t = e_{t-1} + u f_t + \epsilon_t = \Phi r_{t-1} + u f_t + \epsilon_t,$$

→ also a VAR(1)

the $h$-period cumulative mean return conditioned on systematic shock $f_t^{\text{shock}}$ is

$$E \left[ r_{t:t+h} \mid f_t = f_t^{\text{shock}} \right] \approx (I - \Phi)^{-1} u f_t^{\text{shock}}.$$
Introduction of financial innovation: summary

High costs of diversification $c \Rightarrow$ small diversification $m \Rightarrow$ heterog. portfolios and P&L $\Rightarrow$ individual feedbacks weak and uncoordinated.

Introduction of financial innovation makes: $\downarrow c \uparrow m \downarrow \sigma_p \uparrow \lambda$

Hence we have:

1) Increase in leverage $\lambda \Rightarrow$ increases risk exposure

2) Increase in diversification $m \Rightarrow$ increases correlations

3) Increase in $\lambda$ and $m \Rightarrow$ increases endogenous feedback $\Rightarrow \uparrow$ var, cov & corr

So, individual reaction more aggressive (due to higher leverage) and more coordinated (due to higher correlation) $\Rightarrow$ aggregate feedback between prices and total asset $\Rightarrow$ makes bank total asset $A$ more erratic $\Rightarrow$ liquidity and funding booms and bursts
Simulation results: simulated structural break

Asset evolution of fin institutions

Structural Break at 1000:
1) low diversification and leverage
2) high diversification and leverage
Summary & conclusions

i. ↓ diversification costs, by relaxing the VaR constraint, allows FIs to ↑ leverage

ii. it also ↑ portfolio overlap, and thereby correlation, between FIs;

iii. higher overlap induced by ↓ diversification costs increases both the variance and correlation of the investment demands of FIs rebalancing their portfolios;

iv. the feedback between investment prices and bank asset induced by portfolio rebalancing leads to a multivariate VAR process whose max eigenvalue depends on the degree of leverage and average illiquidity of the assets;

v. higher diversification, by increasing the strength and coordination of individual feedbacks, can lead to dynamic instability of the system;

vi. the VAR process can be represented as a combination of many idiosyncratic AR processes around a single common AR process of the average values;

vii. the endogenous feedback introduces an additional component to the var, cov, and correlation of both the individual investment and the bank portfolios;
viii both the variance and correlation of individual investments monotonically increase with a reduction in the diversification costs;

ix a simple variance multiplier exists for the variance of the market portfolio.

x the relation between the portfolio variance and diversification costs is non-monotonic

xi the endogenous feedback makes historical estimation of var-cov to be overestimated during periods of increasing leverage and underestimated during periods of deleveraging;

xii even in absence of feedback effects, ↑ diversification ↑ both the probability of default (in case of large systematic shocks) and correlations, thus exposing the economy to a higher level of systemic risk;

xiii with endogenous feedbacks, a negative realization of the common factor will trigger a sequence of portfolio rebalances which will amplify its initial impact;

xiv the variability of bank total asset, which governs the supply of credit and liquidity to financial system, is highly sensitive to variation in the costs of diversification.
The homogeneity assumptions make the model analytically solvable allowing it to give several insights and results. However, the model can be extended in several directions and used for different purposes:

- **Dynamics and non-linearities**
  - diversification cost as a non-linear function of portfolio size
  - diversification cost dynamics as a function of the bank sector size
  - non-linear impact and/or liquidity endogeneization

- **“Agentification” of the model:**
  - the role of heterogeneity of banks and investments (size, volatility, risk aversion, liquidity, etc)
  - other portfolio optimizations (Markowitz, intensity of choice, etc.)
  - agents with different time horizons

- **Model as a testbed for alternative capital requirement and microprudential policies**
  - Institution specific capital requirements

- **Credit risk “version” of the model**
Keynote Speakers:

- Ignazio Angeloni, Director General Financial Stability, European Central Bank.
- Domenico Delli Gatti, Economics Professor at Catholic University, Milan, Italy.
- Peter Howitt, Lyn Crost Professor of Social Sciences, Department of Economics, Brown University, USA

Submission:
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