Mandatory Central Clearing and Financial Risk Exposure

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European University Institute

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Definition and Research Agenda

OTC Derivatives:
• Bilateral contracts over transfers that are conditional on the future realized state of an underlying asset.
• Used to hedge asset risk, but exposes counterparties to default risk.

This Paper:
• Studies the effect of mandatory counterparty default insurance (central clearing) of OTC derivatives on buyers, sellers and insurers (CCPs).
• Assesses the overall impact on financial risk.

Results:
• Smaller buyers and sellers exit the market (increased market risk), while larger sellers insure more and become safer (decreased credit risk).
• Model calibration and policy evaluation show increase in market risk to dominate.
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Overview

1. Motivation
   1.1 Background
   1.2 Research Agenda & Literature Review

2. Theoretical Analysis
   2.1 Model Environment
   2.2 Equilibrium Notion
   2.3 Mandatory vs Voluntary Insurance

3. Simulation

4. Conclusion
Market Risk:

- Large firms, hedge funds, investment funds and pension funds hold risky assets.
- They buy OTC derivatives from banks or broker-dealers to hedge their asset risk.
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Counterparty Default Risk:
- Dealers can (and do) default on OTC transfers, e.g. Lehman Brothers.
- Caused by losses on OTC derivatives, or more likely other business losses.
Over-The-Counter (OTC) Derivatives

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Counterparty Default Insurance:
- Central Counterparties (CCPs) provide counterparty default insurance.
- Ex ante, they collect collateral to lower default risk.
- Upon default they manage and ensure contracted payments.
Post Lehman default, G20 countries introduced mandatory default insurance.

- Lower credit risk exposure:
  - Significant increase in share of insured OTC derivatives.
  - Significant increase in the collateral provided by both counterparties.

- Higher market risk exposure:
  - CCPs often monopolists within an asset class and increase prices.
  - Smaller buyers and sellers reported difficulties to access the market.

Higher Market Risk Exposure \(\Rightarrow\) Lower Credit Risk Exposure
Mandatory Counterparty Default Insurance

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Research Agenda

What is the effect of the mandatory counterparty default insurance of OTC derivatives on aggregate financial risk?
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1. Discussing competition in the markets of OTC derivatives and their insurance.

2. Analyze a monopolistic CCP’s ability to influence the market outcome under both mandatory and voluntary insurance.

3. Study the effect of a regime shift on aggregate financial risk.
Literature & Contribution

**OTC Prices and Competition:** search frictions (Duffie et al., 2005), random match with Nash bargaining (Koepll et al., 2012; Huang, 2019), take-it-or-leave-it offer (Biais et al., 2012), horizontal differentiation (Perez Saiz et al., 2012).

- **Heterogeneous** switching cost in the presence of trading-platforms.

**Monopolistic for-profit CCPs:** Optimal capital choices (Huang, 2019), maximize profit in the absence of price discrimination (Capponi and Cheng, 2018).

- The **spillover effect** of CCP choices on competition in the OTC derivatives market.

**Mandatory Insurance and Financial Risk:** Netting benefits of CCPs (Ghamami and Glasserman, 2017), systemic risk and for-profit CCPs (Capponi and Cheng, 2018).

- The **interaction** between market structure and micro-prudential policy.
- **Heterogeneous** impact on different buyers, sellers and the CCP.
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Model Environment

Three dates:

- \( t = 0 \): Risky endowments are received and types decided.
- \( t = 1 \): All trades take place.
- \( t = 2 \): Uncertainty resolves and agents decide whether to strategically default.
Model Environment

**Three dates:**
- $t = 0$: Risky endowments are received and types decided.
- $t = 1$: All trades take place.
- $t = 2$: Uncertainty resolves and agents decide whether to strategically default.

**Three types of agents:**
- Risk-averse buyers.
- Risk-neutral sellers: Clearing members and non-clearing members.
- For-profit monopolistic CCP.
Markets and Competition

Derivatives Market (Product $d$):

$t = 0$: Each buyer is matched with one seller and endowed with $n_b$ risky assets.

$t = 1$: Buyers purchase product $d$, paying costs $C$ when **switching** to another seller.

→ **Sellers** compete in prices subject to switching cost frictions and discrimination.

$t = 2$: Uncertainty is realized, seller default observed and conditional transfers made.

Insurance Market (Product $m$):

$t = 0$: The monopolistic CCP sets a two-part tariff for insurance.

$t = 1$: Product $d$ counterparties mutually agree whether to purchase insurance.

→ Risk-neutral sellers ask a take-it-or-leave it price for their agreement.

→ Clearing members ask for a (competitive) price to intermediate with CCP.

$t = 2$: CCP covers transfers for insured product $d$ s with defaulting sellers.
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$t = 2$: CCP covers transfers for insured product $ds$ with defaulting sellers.
Sub-game perfect Nash equilibrium with incomplete information.

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<th>Mandatory Insurance</th>
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<td>$t = 2$</td>
<td>Transfers given buyer allocation, seller default and <em>product choices</em>.</td>
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<td>Buyers decide whether to additionally purchase insurance <em>product m</em>.</td>
<td>Buyers decide whether to purchase the <em>bundle</em> of product $d$ and $m$.</td>
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<td>$t = 1$</td>
<td>Buyers choose whether and from which seller to purchase <em>product d</em>.</td>
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<td>CCP sets fees and collateral; sellers become clearing members.</td>
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## Summary of Theory Results

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|        |                           | | • More buyers are insured.  
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$\rightarrow$ Ambiguous effects on buyers’ risk exposure: **financial risk trade-off**.

$\rightarrow$ Positive effect on seller credit risk: **credit risk externality**

$\rightarrow$ Aggregate effect depends on model parameters and buyer size distribution.
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Counterfactual Policy Evaluation

Parameterization:

- Parameterize the model for quarterly EuroDollar FX OTC derivatives.
- Here, data collection started in 2015 and to this date, insurance is still voluntary.
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Model Calibration:

- Solve the equilibrium under voluntary insurance and verify.
- Perform a counterfactual analysis introducing mandatory insurance.
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Financial Risk Analysis:

- Compute and compare average buyer’s exposure to risk.
- Compute and compare average seller’s credit risk.
Counterfactual Policy Evaluation

(a) Buyer Utility

(b) Seller Profits

(c) Seller Default Probability

Table: The Effect on Financial Risk Exposure

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**Theoretical Analysis:**

- Mandatory insurance empowers the monopolistic *for-profit* CCP to set higher prices.
- Therefore, *smaller* buyers and sellers *exit* the market → increased market risk.
- *Larger* buyers and sellers insuring more → decreased credit risk.

⇒ Buyer size distribution determines the aggregate effect of mandatory insurance.
Conclusion

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Counterfactual Policy Evaluation:
- The EuroDollar FX Market is populated by many small buyers.
- Insurance provides little additional value even to large buyers.

⇒ Mandatory insurance would result in a significant increase in financial risk exposure.
Conclusion

• Mandatory insurance empowers the monopolistic for-profit CCP to set higher prices.

• Therefore, smaller buyers and sellers exit the market.
  → Increased market risk exposure.

• Larger buyers and sellers became safer by insuring more with higher collateral.
  → Decreased credit risk exposure

• Safer sellers also benefit other financial markets.
  → Credit risk externality

⇒ Buyer size distribution determines the aggregate effect of mandatory insurance.
Thank You!


The Risk-Averse Buyers

- Finite, but large number $B$ of buyers with mean-variance utility:

$$u(x) = E(x) - \frac{\gamma}{2} Var(x) \quad \text{where} \quad \gamma > 0$$

(1)
The Risk-Averse Buyers

Model.Env.

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\[
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- At \( t = 0 \) each buyer is endowed with \( n_b \sim U(0, n_B) \) different risky assets with i.i.d. returns \((1 + \tilde{R}) \sim N(\mu_R, \sigma^2_R)\).

Reservation Utility: \( u_R = \mu_R - \frac{\gamma}{2} \sigma^2_R \tag{2} \)
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- At $t = 2$ the derivative seller(s) may default on positive transfers with an expected probability $\hat{D}_s$:
  \[ u_d = \left(1 - \hat{D}_s\right) \mu_R + \hat{D}_s u \left(1 + \tilde{R} \mid \tau > 0\right) - P_d \tag{3} \]
The Risk-Neutral Sellers

- Finite, but large number $S$ of risk-neutral sellers.
- Sell derivatives at $t = 1$, where transfers realize at $t = 2$. 

- At $t = 2$ they receive i.i.d. profits from other business lines: $L \sim N(0, \sigma^2_L)$.
- Can strategically default after observing the realization of $L$ and their total sales:
  \[ D_s = \Pr(\Pi_s^2 \leq 0) \] (4)
- Maximize total profits, taking strategic default into account:
  \[ E_0 \Pi_s = \max P_d \Pi_0^s + E_0 \Pi_1^s + (1 - D_s) E_0 \left[ \Pi_2^s \mid \Pi_2^s > 0 \right] + D_s^* \] (5)
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The CCP’s Profit Function

- Expected numbers of clearing members and membership fee: \( M \) and \( f_M \)
- Expected product \( m \) sales of a clearing member and clearing fee: \( Q_m \) and \( f \)
- Clearing members’ expected default probability given collateral: \( D_M(g_M) \)
- CCP’s expected losses from a single seller’s default: \( \Pi_{CCP}^2 \)
- CCP’s profit maximization problem:

\[
E_0 \Pi_{CCP} = \max_{\{f_m, f, g_M\}} \overline{M}f_M + \overline{M}Q_M2f + \overline{M}D_M(g_M)\Pi_{CCP}^2(g_m)
\]
<table>
<thead>
<tr>
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<th>Notation</th>
<th>Value</th>
<th>Method</th>
<th>Data Source</th>
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<tbody>
<tr>
<td>Buyer size</td>
<td>(a_b \sim Weibull(\lambda, k))</td>
<td>(\lambda = 0.686, \ k = 0.689)</td>
<td>SMM</td>
<td>Hau et al. (2021)</td>
</tr>
<tr>
<td>Asset Return</td>
<td>((1 + \tilde{r}) \sim N(\mu_r, \sigma^2_r))</td>
<td>(\mu_r = 1.012, \ \sigma_r = 0.095)</td>
<td>return of US corp. bonds and exchange rate volatility</td>
<td>St. Louis Fed (2021) Bundesbank (2021)</td>
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<td>Risk Aversion</td>
<td>(\gamma)</td>
<td>(\gamma = 4.37)</td>
<td>-</td>
<td>Eisfeldt et al. (2020)</td>
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<td>Seller profits</td>
<td>(L \sim N(\mu_L, \sigma_L))</td>
<td>(\mu_L = 199.846, \ \sigma_L = 115.169)</td>
<td>avg., std.</td>
<td>S&amp;P Global (2021)</td>
</tr>
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<td>Collateral Cost</td>
<td>(\delta)</td>
<td>(\delta = 0.000636)</td>
<td>avg. EURIBOR</td>
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<td>Switching Costs</td>
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