State aid and tacit collusion

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Question: Can state aid affect the competitive state of an industry?

Key idea: State aid guarantees repeated interaction!

1. It prevents that my firm fails and has to leave the market.
2. It guarantees that my competitor(s) are still in the market in the future.

=> State aid facilitates *collusive behaviour*, because *harsher punishments* can be implemented!

**welfare trade-off:**
What are the costs and benefits of state aid? Under what conditions is state aid welfare enhancing and when not?

Application: We apply our model to the banking industry.
Outline of the talk

1. Introduction, motivation and contribution
2. Related literature
3. The model
4. Results on competitive behavior
5. Results on consumer welfare
6. Conclusion
State aid has played and still plays an ample role during the financial and economic crisis and its aftermath:

- The number of newly introduced state aid measures in the non-financial sector of the EU and the amount of aid to be recovered is steadily increasing. E.g. the number of newly introduced measures more than doubled between 2006 and 2009, while the amount of aid to be recovered (illegal aid or subsidies) grew from € 30m in 2005 to € 900m in 2009.\(^1\)

- The financial sector was supported by European member state governments with 300 billion Euros in capital injections and almost 3 trillion Euros of guarantees.\(^2\)

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\(^1\)http://ec.europa.eu/competition/state_aid/studies_reports/measures.html

\(^2\)http://ec.europa.eu/competition/recovery/financial_sector.html
Introduction & motivation (cont.)

Possible costs of state-aid:

► can promote productive, allocative and dynamic inefficiencies by distorting the competitive process
► can create moral hazard
► detrimental strategic trade policy and tax competition

Possible benefits of state-aid:

► resolution of a market failure
► raising positive externalities

... Typically a careful evaluation of all costs and benefits is difficult.

In the financial sector swift action is essential and perceived strong positive externalities in the short-run (see Lyons (2009) or Tirole (2010)) lead to interventions on a regular scale.
Contribution

Our paper highlights a novel cost of a systematic state aid policy:

- We find that a policy aimed to systematically rescue firms in the presence of negative idiosyncratic shocks facilitates tacit collusion!

- We examine the impact of state aid on firms’ incentives to collude and its welfare implications!

To our knowledge the existing literature focused solely on the effect of state aid on firms’ unilateral behaviour BUT NOT on firms’ collective behaviour!
Related literature

Literature on state aid:

- *State aid and tacit collusion* ??
Related literature (cont.)

Banking literature on competition:

▶ Possible trade-off financial stability vs. competition, see Allen and Gale (2004) or Vives (2010).

Building blocks of our paper:

▶ Oligopolistic version of Klein-Monti (1971, 1972) model as developed by Freixas and Rochet (2008).
The model - setup

- Time is discrete: \( t = 1, \ldots, \infty \).
- Players maximize expected payoff and discount with \( 0 < \delta < 1 \).
- The economy is populated by depositors and 2 banks at \( t = 1 \).
- The bank duopoly competes in the deposit market. Each bank can invest in a risky asset. Barriers to entry are very high.
- Depositors have an upward-sloping demand curve for deposits (a homogeneous product) as in the oligopolistic extension of the Klein-Monti model by F&R.
- Banks set net interest rates \((r_1, r_2)\) simultaneously at the beginning of each period. They cannot price-discriminate.
- Linear demand: \( Q(r) = \min \{ \bar{Q}, \max\{0, r_1, r_2\} \} \).
Technology:

- Each bank has access to one asset (project) with stochastic return:

\[ \tilde{R} = \begin{cases} 
R_H & \text{w.p. } p \\
R_L & \text{w.p. } (1-p) 
\end{cases} \]

where \( R_H > 0 \) and \( R_L < 0 \) are denote the net returns per unit invested in the good and in the bad state, respectively.

- Distribution of asset returns is \( i.i.d. \) \( \implies \) banks face idiosyncratic shocks!

Assumptions:

- \( R_H < \bar{Q}, R_L = -1 \)
- **Condition 1:** \( R_H > 4 \frac{1-p}{p} \).
The model - demand

Demand for deposits.

\[ \Phi C_2 = - \frac{R_H}{2} : \text{potential loss from bankruptcy; here whenever a monopolist fails or both banks of a collusive duopoly fail} \]
The model - timeline

The timeline of the game (w/o State aid).

*At each time* $t$:

- Consumers choose their bank.
- Banks stay (pay gross interest) or exit (c. k.).
- Shocks realise $R_H (p)$ and $R_L (1-p)$ (c. k.).
- Individuals receive capital plus interest and consume it ($p$) or lose everything ($1-p$).

$r_1, r_2$ are set (common knowledge).
Problem of a bank

Every period bank $i = 1, 2$ maximizes profits:

$$\max_{r_i} \pi = p \ast ((R_H - r_i) \ast Q(r_i, r_j)) + (1 - p) \ast 0,$$

taking into account the possibility to (tacitly) collude for high enough discount factor (Stigler)! 

If a bank is alone in the market, then we have:

$$r^M = \frac{R_H}{2}, \quad Q(r^M) = \frac{R_H}{2} \quad \text{and} \quad \pi^M = p \ast \left(\frac{R_H}{2}\right)^2.$$

Under competition we have instead:

$$r^C = R_H, \quad Q(r^C) = R_H \quad \text{and} \quad \pi^C = 0.$$
Policy

State aid:

- When a bank fails the government / regulator renews the bank’s authorization to operate next period.
- The cost of avoiding bankruptcy is $\gamma \geq 0$.

National deposit insurance scheme (NDIS):

- 100% of deposits covered when a bank fails (capital is returned without interest).
- NDIS applies to both regimes (aid and no aid).

Financing:

- Lump-sum tax to fund NDIS and State aid.

$\Rightarrow$ NDIS allows to isolate the effect of State aid on collective competitive behavior!
Results on competitive behavior

Proposition 1: State aid and collusion

In the presence of idiosyncratic shocks, a State aid policy that keeps banks (firms) in business after a shock facilitates tacit collusion; that is, tacit collusion can be sustained for lower values of discount factors.

To see this we have to compare the ICC without State aid to the ICC with aid and compute the critical discount factors.
Results on competitive behavior (cont.)

ICC without State aid:

\[
\inf_{t=1} \sum_{t=1}^{\infty} \delta^{t-1} \left( p^{2t-1} \pi^M + p^t (1 - p^{t-1}) \pi^M \right) \geq p \pi^M + \sum_{t=1}^{\infty} \delta^{t-1} \left( p^{2t-1} \pi^C + p^t (1 - p^{t-1}) \pi^M \right) \Rightarrow \delta^{NA} = \frac{1}{2p^2}.
\]

ICC with State aid:

\[
\inf_{t=1} \sum_{t=1}^{\infty} \delta^{t-1} \left( p \pi^M \frac{\pi^M}{2} + (1 - p) \ast 0 \right) \geq p \pi^M + (1 - p) \ast 0 + \sum_{t=1}^{\infty} \delta^{t-1} \left( p \pi^C + (1 - p) \ast 0 \right) \Rightarrow \delta^{A} = \frac{1}{2}.
\]
Results on competitive behavior (cont.)

Probability of good shock occurring and discount factors determining *collusive vs. competitive outcomes*.

- **Collusion in both regimes**
- **Competition in both regimes**
- **Competition without aid**
- **Collusion with aid**

\[ \text{Delta} \]

\[ \text{p} \]

\[ 0.0 \quad 0.1 \quad 0.2 \quad 0.3 \quad 0.4 \quad 0.5 \quad 0.6 \quad 0.7 \quad 0.8 \quad 0.9 \quad 1.0 \]

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Results on consumer welfare (social welfare)

To compare welfare under the two aid regimes for the case of competition and of collusion we have to capture all possible scenarios with their respective probabilities and welfare levels.

E.g. w/o aid and collusion (i.e. $\delta \geq \frac{1}{2p^2}$) we have 6 possible states of a consumer in terms of welfare in period $t$:

(I) A **collusive duopoly** exists at a given time $t$ and there is no failure, (II) 2 failures or (III) 1 failure in period $t$.

(IV) There is a **monopoly** and the bank does not fail in period $t$ or (V) it does fail in period $t$.

(VI) There is **no market** (both banks failed before period $t$).
6 possible states for the case: collusion without aid

<table>
<thead>
<tr>
<th>state</th>
<th>probability</th>
<th>consumer welfare</th>
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<tbody>
<tr>
<td>(I)</td>
<td>$p_I(t) = p^{2^t}$</td>
<td>$W^C = \frac{1}{2} \left( \frac{R_H}{2} \right)^2$</td>
</tr>
<tr>
<td>(II)</td>
<td>$p_{II}(t) = p^{2(t-1)}(1-p)^2$</td>
<td>$\Phi_{C2} = -\frac{R_H}{2}$</td>
</tr>
<tr>
<td>(III)</td>
<td>$p_{III}(t) = 2(p^{2(t-1)}(1-p)p)$</td>
<td>$\frac{W^C}{2} + \Phi_{C1} = \frac{1}{4} \left( \frac{R_H}{2} \right)^2 - \frac{R_H}{4}$</td>
</tr>
<tr>
<td>(IV)</td>
<td>$p_{IV}(t) = 2p^t(1-p^{t-1})$</td>
<td>$W^M = \frac{1}{2} \left( \frac{R_H}{2} \right)^2$</td>
</tr>
<tr>
<td>(V)</td>
<td>$p_{V}(t) = 2p^{t-1}(1-p)(1-p^{t-1})$</td>
<td>$\Phi_{C2} = -\frac{R_H}{2}$</td>
</tr>
<tr>
<td>(VI)</td>
<td>$p_{VI}(t) = 1 - \sum_{k=1}^{V} p_k(t)$</td>
<td>0</td>
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</table>
Proposition 2: State aid and consumer welfare

(i) In the range of discount factors such that there is competition in absence of State aid but tacit collusion with State aid, such a policy reduces consumer welfare. That is, $E(W^A_C) < E(W^{NA}_{NC})$, for all $\frac{1}{2} \leq \delta < \frac{1}{2p^2}$. This is true even if $\gamma = 0$.

(ii) In an environment where duopolistic banks (firms) compete regardless of whether there is State aid ($\delta < \frac{1}{2}$), such a policy reduces consumer welfare iff $\gamma > \gamma_C > 0$.

(iii) In an environment where duopolistic banks (firms) can sustain tacit collusion regardless of whether there is State aid ($\delta \geq \frac{1}{2p^2}$), such a policy reduce consumer welfare iff $\gamma > \gamma_{NC} > 0$. 
Results on consumer welfare (cont.)

Effect of State aid on consumer welfare, by discount factor.
Conclusion

- Existing literature typically focused on adverse efficiency effects of aid policies (misallocation of resources, moral hazard) and on countervailing arguments based on equity, cohesion and social policy.

- We develop an infinite-horizon model that sheds light on a new aspect by examining the impact of state aid on collective competitive behavior. ⇒ Result: State aid facilitates (tacit) collusion and thereby reduce social welfare!

- Insight holds more general - not only for the banking industry.

Possible extensions:

- ...
The definition of State aid stems from Article 87(1) of the EC Treaty which states that:

"Any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market."