Bailouts and Financial Innovation:
Market Completion Versus Rent Extraction

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Abstract

This paper examines the role of bailouts in completing markets as well as in inducing rent-seeking. When finanical markets are incomplete, contingent transfers can substitute for missing markets and improve welfare. We term this the *market completion* effect of bailouts. However, when such transfers are linearly dependent with existing markets, then they introduce arbitrage possibilities unless they are offset by insurance premia that precisely reflect the marketable fraction of the transfers. These arbitrage possibilities are commonly referred to as the moral hazard induced by bailouts and may result in large levels of *rent extraction*. The resulting equilibria are characterized by high volatility and reduced welfare for the rest of the economy. When the market structure is endogenous, the existence of mis-priced contingent transfers encourages the creation of securities that allow market participants to engage in arbitrage and rent extraction.

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1 Introduction

In the recent financial crisis, governments around the world have provided unprecedented bailouts to failing financial institutions. In many instances, the magnitude of losses that was covered by government bailouts was exacerbated by recent financial innovations, including subprime mortgages, credit default swaps, and repos. For example, AIG was rescued after accumulating large losses from selling credit default protection . The losses of Fannie Mae and Freddie Mac and many insured savings banks like Washington Mutual were accentuated by an explosion in their underwriting of subprime mortgages (see Acharya et al., 2011). An entire industry has developed to structure bank liabilities so as to maximize the value of FDIC-provided deposit insurance (see e.g. Shibut, 2002).[1] Investment banks structured mortgage-backed securities in ways that they would just obtain a favorable credit rating, i.e. "rating at the edge," thereby minimizing capital requirements (Brunnermeier, 2008).

Economists are sharply divided on the desirability of bailouts – some claimed that the bailouts in the financial crisis of 2008/09 were instrumental in avoiding another Great Depression, while others decried them for distorting incentives and providing welfare for the rich, arguing that governments should commit to refrain from any future bailouts.

The contribution of this paper is to provide an integrated framework of these two views to analyze the welfare effects of bailouts and the interaction of financial innovation and bailouts. This offers novel insights into (i) the desirability and optimal design of bailouts, (ii) the optimal design of regulation to offset the distortions from bailouts, (iii) the desirability of financial innovation and (iv) the effects of financial innovation on the share of aggregate resources going to the financial sector versus the rest of the economy.

When finanical markets are incomplete, contingent transfers can substitute for missing markets and improve welfare. We term this the *market completion* effect of bailouts. However, when such transfers are linearly dependent with existing markets, then they introduce arbitrage possibilities, unless they are offset by insurance premia that precisely reflect the mar-

[1] This includes using repos to replace interbank lending (which is subordinated to FDIC-insured deposits) by secured lending; deposit-brokering and splitting, which distributes funds to a larger number of banks subject to the deposit insurance limit per person per individual bank; taking on short-term liabilities that are legally junior to FDIC-insured deposits but can be quickly withdrawn in the event of financial difficulties so that the FDIC becomes effectively junior.

ketable fraction of the transfers. These arbitrage possibilities are commonly referred to as the "moral hazard" induced by bailouts and may result in large levels of *rent extraction*. In our model economy, rent extraction may lead to situations when the financial sector extracts all surplus from the real economy in all states of nature.

When the market structure is endogenous, the existence of mis-priced contingent transfers encourages the creation of securities that allow market participants to engage in arbitrage and rent extraction. The incentives to create new markets are higher when these markets are used for rent extraction than when they are used for insurance purposes. In a production economy, the quest for rent extraction induces agents to undertake massively negative net present value investments.

The paper develops a simple model to illustrate our results in a quasi-Edgeworth box. There are two sets of agents, bankers and households, and two states of nature. We assume that the endowment of bankers is risky; that of households is constant, creating a scope for insurance opportunities. The paper first desribes the decentralized equilibrium if a market to trade claims across the two states of nature exists. Then we analyze how a planner can substitute for such a market by making state-contingent transfers. We analyze different transfer rules and focus on a rule that guarantees a minimum wealth level to bankers in each state, which can be justified if they are essential to the rest of the economy. When we put the market and the transfer rule together, arbitrage possibilities arise – except if the transfer rule imposes a tax on risk-taking that corresponds precisely to the market value of the resources transferred.

In a symmetric equilibrium, bankers extract all the resources from households in the state of nature in which the aggregate endowment is high and receive a bailout in the low state of nature. However, in a symmetric equilibrium, bankers still leave money on the table. Under some circumstances, they find it optimal to choose a mixed strategy equilibrium in which they form two groups that bet against each other and extract a bailout with probability one. In this equilibrium, inspired by the credit default swaps that were transacted between Goldman and AIG, bankers extract the entire aggregate wealth of the economy from households.

Literature The literature has long discussed that bailouts provide incentives for financial institutions to increase their risk-taking (see e.g. Bagehot, 1873 or, more recently, Farhi and Tirole, 2011, among many others). Much of this literature finds that it would be optimal for government to commit not to bail out in the event of crisis. If private agents do not expect bailouts, they will then choose to take on the efficient amount of risk. However, the usefulness of this prescription has been at best moderate in practice. Gormley et al. (2011) provides empirical evidence that government promises not to bail out are not credible.

This paper incorporates this view but argues that even anticipated bailouts may be desirable when financial markets are incomplete because they serve to complete markets. However, as financial innovations proceeds, the scope for rent extraction increases and the distortive effects of bailouts may exceed the benefits of market completion.

Our paper is also related to a nascent literature that links developments in the financial sector to growing inequality (see e.g. Philippon and Reshef, 2009). We show in this paper that some types of financial innovation may be directed at rent extraction and may lead to outcomes in which the financial sector can extract a growing share of the economic surplus created by an economy.

2 Model Setup

Assume an economy with two sets of atomistic agents of mass 1 called households and bankers, which we label by the subindices $i = h, b$. There are two states of nature $s \in \{1, 2\}$ with probabilities that are w.l.o.g. $\pi \geq \frac{1}{2}$ and $1-\pi$. There is one homogenous consumption good in each state. The preferences of both agents are given by a linearly separable utility function

$$U_i\left(c_i\right) = E\left[u\left(c_{is}\right)\right]$$

where c_{is} is the consumption of agent i in state s and $u\left(c_{is}\right)$ is a strictly increasing twice continuously differentiable function. We denote the vector of consumption of agent i as $c_i = \left(c_{i1}, c_{i2}\right)'$.

Households are born with a constant endowment e in both states, which we denote by the wealth vector $e_h = (e, e)'$. Bankers are born with an endowment of e in state 1 and $e_L \leq e$ in state 2, denoted by $e_b = (e, e_L)'$. One possible interpretation (but by no means the only interpretation) of state 2 is that it represents a "rare disaster." We summarize the endowment of agents in the economy by the matrix $E = (e_h, e_b)$.

In the following, we study the allocations in the economy resulting from different allocation systems.

2.1 Autarky

If there are no transfer systems available, the only feasible allocation is the autarky allocation $\mathcal{A}$ in which the wealth of each agent coincides with his endowment. The wealth matrix of the economy is therefore $W = E$, and the utility levels of the two agents in this allocation are

$$U_h = U(e_h) \qquad \text{and} \qquad U_b = U(e_b)$$

2.2 Walrasian Market

Suppose instead that there exists a Walrasian market $\mathcal{M}$ in which households and bankers trade claims. (If we interpret s as time, this market opens at time $s = 1$. If we interpret s as states of nature, this market opens before the state of nature is realized.) Denote by p the price of $s = 2$ goods in terms of $s = 1$ goods and by b the amount of $s = 2$ goods that households sell to bankers.

Both sets of agents $i \in \{h, b\}$ maximize their utility while taking the price p as given to obtain a demand/supply schedule $b_i(p)$. Household supply $b_h(p)$ is upward-sloping and banker's demand $b_b(p)$ is downward-sloping. The Walrasian auctioneer determines the market-clearing price p^{DE} at which $b_h(p) = b_b(p)$. (We use the superscript DE when it is helpful to explicitly refer to variables in the decentralized equilibrium.)

Each atomistic agent understands that market exchange is akin to a linear technology to tranfer resources from $s = 1$ to $s = 2$ such that $y_1 = py_2$. In equilibrium the marginal rates of substitution of both agents equal the market's marginal rate of transformation,

$$\frac{u'(c_{i2})}{u'(c_{i1})} = p$$

We denote the vector of market exchanges between households and bankers in the Walrasian equilibrium allocation as $z^{DE} = (-bp, b)'$ and we collect the resulting wealth levels in the matrix $W = (w_{h,} w_b)$ where $w_h = e_h - z^{DE}$ and $w_b = e_b + z^{DE}$.

2.3 Transfer Allocations

Now suppose that there is no market to exchange claims between $s = 1$ and $s = 2$ but a planner who has the power to transfer resources. We denote by $t = (t_1, t_2)'$ a vector of transfers from households to bankers.

Given a wealth matrix W, the *set of feasible transfers* includes all transfer that satisfy the non-negativity constraint on each agent's consumption,

$$t \in [-w_{b1}, w_{h1}] \times [-w_{b2}, w_{h2}].$$

Let us describe various subsets within this set. Define T^{PI} as the set of all Pareto-improving transfers that make at least one agent better off and nobody worse off than the initial allocation,

$$T^{PI} = \{t \in T : U(e_h - t) \geq U(e_h), U(e_b + t) \geq U(e_b)\}$$
$$\text{with one strict inequality}$$

Next define T^{PO} as the set of all Pareto-optimal transfers, i.e. transfers that lead to Pareto-efficient allocations from which no agent can be made better off without hurting another agent,

$$T^{PO} = \left\{ t \in T : \exists p \text{ s.t. } \frac{u'(c_{i2})}{u'(c_{i1})} = p \forall i \right\}$$

The two sets T^{PI} and T^{PO} overlap but neither is a subset of the other. The market exchange vector z^{DE} in the Walrasian equilibrium is an element of both T^{PI} and T^{PO}.

Finally, the set T^B captures what we may call "pure bailouts" in which the planner transfers resources from households to entrepreneurs for nothing in return,

$$T^B = \{t \in T : t_s \geq 0 \forall s \text{ with one strict inequality}\}$$

2.3.1 Transfer Rules

Let us next describe how a planner selects her transfer t. We define a transfer rule as a mapping from the wealth positions W of all agents to a vector of transfers $W \to t$.

The first transfer rule that we consider is an *uncompensated subsistence transfer* τ^{un} from households to bankers with a subsistence level x. (For now we just take this rule as given. We will describe conditions under which such an arrangement may be optimal in section 3.1 below.) We assume $2x < \Sigma_i w_{si} \forall s$, which ensures that it is feasible for both sets of agents to consume at least x in all states of nature s.

$$\tau_s^{un} = \max\{0, x - w_{se}\} = \begin{cases} 0 & \text{if } w_{se} \geq x \\ x - w_{se} & \text{if } w_{se} < x \end{cases} \tag{1}$$

Bankers receive a transfer that brings their consumption to x in case their wealth is insufficient to reach this level. Uncompensated subsistence transfers constitute pure bailouts.

Next we consider a *compensated subsistence transfer* that imposes a tax t_r on bankers in state r and rebates it to households in order to offset the transfers t_2 that bankers receive from households in another state $s \neq r$. Assume w.l.o.g. that bankers receive a non-negative transfer in state $s = 2$ that takes the form $t_2 = \max\{0, x - w_{2e}\} \geq 0$. The planner offsets this transfer by a tax liability in state $s = 1$ of

$$t_1 = \tau(t_2) \leq 0 \text{ with } \tau(0) = 0 \text{ and } \tau'(t_2) \leq 0.$$

We call the function $\tau(t_2)$ the compensation rule for transfer t_2. We identify the iso-utility curves of households and bankers for pairs of transfers (t_1, t_2) that leave them indifferent to the inital allocation. These curves satisfy the equations $t_1 = \tau_{\bar{U}_h}(t_2)$ and $t_1 = \tau_{\bar{U}_e}(t_2)$. For any $t_2 \in [0, b^{DE}]$, we find that $\tau_{\bar{U}_h}(t_2) < \tau_{\bar{U}_e}(t_2) < 0$. Within this set, we observe that a transfer rule $\tau(t_2)$ leads to a Pareto-improvement if $\tau_1(t_2) \in [\tau_{\bar{U}_h}(t_2), \tau_{\bar{U}_e}(t_2)]$. A compensation rule $\tau \equiv 0$ amounts to an uncompensated subsistence transfer.

2.3.2 Transfer Equilibria and Market Completion

If $e_L < x$, then the compensated transfer for the described economy implies that $(t_1, t_2) = (g(x - e_L), x - e_L)$.

Proposition 1 (Market Completion) *If a market to exchange claims between $s = 1$ and $s = 2$ does not exist, then a transfer rule τ_x with $x \leq b^{DE}$ compensated by a tax $g(t_2) \in [g_{\bar{U}_h}(t_2), g_{\bar{U}_e}(t_2)]$ leads to a Pareto improvement in the economy.*

Proof. See discussion above. ■

If the planner chooses a transfer rule such that $t \in T^{PO}$, then she can implement a Pareto-optimal allocation. In particular, if she sets $t = m^{DE}$, then the transfer rule implements the allocation that would be chosen in the decentralized equilibrium if a market for claims between $s = 1$ and $s = 2$ existed.

2.4 Market Equilibrium under Uncompensated Transfers

Now let us introduce a financial market in which claims on $s = 1$ and $s = 2$ can be traded before the planner applies a given transfer rule. After trade has taken place and before the planner's transfers, the wealth positions of households and bankers are $w_h = (e + pb, e - b)'$ and $w_b = (e - pb, e_L + b)'$. Before proceeding we make the following assumption:

Assumption 1 (Bounded Marginal Utiltiy) *The utility function of agents in the economy satisfies $u'(0) < \infty$.*

This ensures that the optimal market positions of all agents are bounded in a market equilibrium with transfer rules.[2]

2.4.1 Symmetric Equilibrium

Let us first focus on symmetric equilibria in which all households and all bankers follow a uniform strategy. The problem of bankers is to

$$\max_b \pi u(e - pb) + (1 - \pi) u(e_L + b + t_2) \quad \text{where} \quad t_2 = \tau_x^{un}(e_L + b)$$

and the associated first-order condition is

$$-\pi p u'(c_{1b}) + (1 - \pi) u'(c_{2b}) \left[1 + \tau_2^{un\prime}(e_L + b)\right] = 0 \tag{2}$$

Bankers recognize that transfers kick in when the subsistence threshold for wealth is passed. This makes their objective function non-concave at

[2] There are two alternative assumptions that would also lead to this outcome: First, we could assume that the bond position b of agents is bounded so that $|b| < \bar{b}$. Second, we could assume that households cannot commit to make payments that leave them with a wealth level less than a constant $x > 0$.

$w_{sb} = x$. We separate the wealth space of bankers into two regions with $t_2 = 0$ and $t_2 > 0$ and solve for the local maximum in each of the two regions:[3]

Insurance Regime If $t_2 = 0$, bankers choose to optimally insure with $b > 0$ and implement the allocation of the Walrasian market equilibrium as described in section 2.2. Formally, the term τ_2' drops out of the first-order condition of bankers. The resulting level of utility is

$$U_b^{DE} = \pi u \left(e - p^{DE} b^{DE}\right) + (1 - \pi) u \left(e_L + b^{DE}\right)$$

Rent Extraction Regime If $t_2 > 0$, bankers choose the allocation that maximizes the size of the transfer t_2 that they receive by choosing $b \ll 0$. The subsistence level x guarantees a level of period 2 consumption

$$c_{2e} = w_{2e} + t_2 = e_L + b + t_2 = x.$$

which requires a transfer $t_2 = x - w_{2e} = x - e_L - b$. The derivative of the transfer rule is $\tau_2^{un\prime} = -1$ and the term in square brackets in the optimality condition (2) vanishes. It is optimal for bankers to choose the lowest b possible. This is determined by the non-negativity on consumers' period 0 consumption. Consumers are willing to sell their entire state 1 endowment such that $c_{1h} = 0$ by setting $b = -e/p$. In state 2 consumers receive a payment $-b$ from households, but are subjected to a lump-sum tax $t_2 = x - e_L - b$, leading to a consumption level $c_{2h} = e + e_L - x$.

Lemma 1 (Rent Extraction) *If the rent extraction regime is chosen, the consumption levels of households and bankers satisfy* $c_h = (0, e + e_L - x)$ *and* $c_b = (2e, x)$.

Bankers choose the regime in which their total level of utility is higher. (Note that it would not be optimal for bankers to extract transfers in state 1 and consume all resources in the economy in state 2 since that state has a lower probability and a lower aggregate endowment.)

[3] There is also a third region with $t_1 > 0$. However, it can be seen that the local maximum within this region is always dominated by the maximum in the region with $t_2 > 0$. We therefore exclude this possibility from the following analysis.

Proposition 2 (Market Equilibrium Under Uncompensated Transfers)

1. *Bankers choose the rent extraction regime over the insurance regime if and only if* $U^{RE} > U^{DE}$*, or*

$$\pi u(2e) + (1-\pi) u(x) > U^{DE}$$

2. *This condition is more likely to be satisfied the higher* x *and* π *and the lower* e_L*.*

3. *If bankers choose the rent extraction regime, they increase their utility at the expense of households and increase consumption volatility for everybody in the economy.*

Proof. 1. See the discussion above to motivate the inequality.
2. The comparative static results follow directly from this inequality.
3. Since the decentralized equilibrium allocation that corresponds to the insurance regime is Pareto-efficient, the only way for bankers to be better off in the rent extraction regime is for households to be worse off. Consumption volatility for both households and bankers increases since insurance and therefore smoother consumption would require $b > 0$, whereas optimal rent extraction requires $b < 0$. ■

In short, under the rent extraction regime, bankers consume all of the economy's resources in the likelier state 1 and shift all their losses into the less likely state 2 with low aggregate endowment, in which they are nonetheless guaranteed a subsistence consumption level x. This strategy is more attractive the greater the subsistence level x, the smaller the probability of the low aggregate state, and the lower the aggregate resources in that state.

Note that in our example above, households are better off than bankers under the insurance regime since they own greater endowments. However, in the rent extraction regime, the welfare of bankers is unambiguously higher than that of households.

2.4.2 Mixed Strategy Equilibrium

In this section we investigate mixed strategy equilibria in which bankers form two groups to follow two different strategies, labeled $\sigma = I, II$, whereas all households continue to follow a common strategy. (It can be shown that households do not have an incentive to deviate from a common strategy.)

When we defined the transfer rule τ_x^{un} above in (1), we did not consider whether households acutally have sufficient taxable wealth to finance the transfer entailed by the rule. It can be verified that this is always the case in the symmetric rent extraction equilibrium that we characterized above – in that equilibrium, household consumption after the lump sum tax is $c_{2h} = \Sigma_i e_{si} - x > 0$. In an equilibrium in which bankers follow mixed strategies this is no longer guaranteed and we need to refine the transfer rule from above to include an additional condition that ensures that the planner never taxes households more than the wealth that they own.

Denote by n_I the mass of bankers that follow strategy I and by t_{sI} the transfers that these bankers obtain in state s. We cap these transfers at a level $\bar{t}_{sI}$, which we will determine below, for bankers following strategy I,

$$\tau_x^{un} : t_{sI} = \begin{cases} 0 & \text{if } x \leq w_{sbI} \\ x - w_{sbI} & \text{if } x - \bar{t}_{sI} \leq w_{sbI} < x \\ \bar{t}_{sI} & \text{if } w_{sbI} < x - \bar{t}_{sI} \end{cases}$$

and similarly at $\bar{t}_{sII}$ for bankers following strategy II. The two caps are chosen such that $\Sigma_\sigma n_\sigma \bar{t}_{sI} = w_{sh} \forall s$, i.e. that household net worth in each state s is sufficient to cover the sum of all transfers to bankers. (Again, we will discuss under which conditions this may be optimal below.)

Insurance Regime If the insurance regime is chosen, the allocations of all bankers are identical and correspond to the symmetric insurance regime describe above with no transfers, yielding a level of utility U_b^{DE} for bankers.

Rent Extraction Regime If the rent extraction regime is chosen, bankers randomize to follow strategy I or II with probability n_I or $n_{II} = 1 - n_I$ each. W.l.o.g. let us denote the strategy that seeks to extract transfers in state 1 as I and the strategy to extract transfers in state 2 as II. Given these strategies and the taxable income of households, the planner can afford to set the transfer caps to $\bar{t}_{s\sigma} = e/n_\sigma \forall \sigma$. Bankers that follow strategy I choose a payment $pb_I > 0$ so as to extract a transfer $t_{1I} > 0$ in state 1 and solve

$$\max_{b_I} \pi u (e - pb_I + t_{1I}) + (1 - \pi) u (e_L + b_I) \quad \text{where} \quad t_{1I} = \tau_x^{un} (e - pb_I)$$

The derivative of the objective with respect to b_I is positive as long as $x - \bar{t}_{sI} = x - e/n_\sigma \leq w_{sbI}$; therefore the optimum must satisfy $w_{sbI} \leq x - e/n_\sigma$ and similarly for bankers who follow strategy II. In equilibrium, bankers must be indifferent between the two strategies, and they will extract the maximum possible transfer $\bar{t}_{s\sigma}$ in the transfer state s.

Lemma 2 (Mixed Strategy Rent Extraction) *In the mixed strategy rent extraction regime, bankers randomize between strategies I and II with probabilities n_I and n_{II} and achieve consumption allocations $c_{bI} = (x, e + e_L - x_2)$ and $c_{bII} = (2e - x, x_2)$ with $x_2 < x$ determined such that bankers are indifferent between the two strategies*

$$U(c_{bI}) = U(c_{bII})$$

Households, on the other hand, obtain a consumption allocation $c_h = (0, 0)$.

Proof. See discussion above. ■

Note that bankers who follow strategy II will not achieve the subsistence level x since the transfer required to reach this level would exceed the wealth of households. However, they will still choose the described allocation because this is the only way to make them indifferent to households who follow strategy I, since the aggregate amount of resources in the economy is smaller in state 2 in which strategy I households are the winners.

Proposition 3 (Mixed Strategy Equilibrium, Uncompensated Transfers)

1. *Bankers choose the mixed strategy rent extraction regime over the insurance regime if and only if $U^{MRE} > U^{DE}$, or*

$$\pi u(x) + (1 - \pi) u(e + e_L - x_2) > U^{DE}$$

2. *This condition is more likely to be satisfied the higher x and π and the lower e_L.*

3. *If bankers choose the rent extraction regime, they push down the level of household consumption to $c_h = (0, 0)$ and split the spoils across states 1 and 2 among strategy I and II players.*

Proof. The proof follows the same steps as the proof of the previous proposition. ■

2.5 Market Equilibrium Under Compensated Transfers

Let us next return our focus to compensated transfer rules under which a transfer in state s is accompanied by a compensatory tax in state $r \neq s$. Specifically, we assume that entrepreneurs receive subsistence transfers according to transfer rule (1) and the offsetting tax in state $r \neq s$ is determined by a formula $\tau(t_s)$ which satisfies $\tau(0) = 0$ and $\tau'(t_s) > 0$. This changes the optimality problem of a banker who receive a transfer in state 2 to

$$\max_b \pi u\left(e - pb - \tau(t_2)\right) + (1-\pi) u\left(e_L + b + t_2\right) \quad \text{where} \quad t_2 = t_x\left(e_L + b\right)$$

The associated first-order condition is

$$\pi u'(c_{1b})\left[p + \tau'(t_2)\, t_x'(e_L + b)\right] = (1-\pi) u'(c_{2b})\left[1 + t_x'(e_L + b)\right]$$

Bankers recognize that both transfers and taxes kick in when the subsistence threshold for wealth is passed. This makes their objective function non-concave at $w_{sb} = x$.

We follow our analysis above and separate the wealth space of bankers into two regions with $t_2 = 0$ and $t_2 > 0$, solving for the local maximum in each of the two regions. We find:

Proposition 4 (Compensated Transfers and Equilibrium) *If the transfer rule in the economy is set such that $\tau' < p$, then the allocations of the equilibrium with uncompensated transfers in proposition 2 are replicated. If $\tau' \geq p$, then the efficient allocation of the decentralized equilibrium will prevail.*

Proof. The proof is given in the appendix. ■

One way of viewing the proposition is that underpriced transfers for which $\tau' < p$ provide bankers with an arbitrage opportunity: increasing the promised repayment in state 2 allows them to collect a rent $[p - \tau']$ in state 1 at no cost. By sufficiently increasing the promised payoff in state 2, they can extract all of the economy's resources in state 1 and replicate the allocation $c_b = (2e, x)$ as in lemma 1.

The proposition therefore provides clear guidelines for how the compensation for expected transfers is to be set in order to avoid rent extraction.

Note: τ' needs to be set according to the price in the rent-extration regime, not the in the insurance regime. This implies that it has to be significantly higher than the price observed in the regular equilibrium.

Note 2: even small mispricing allows for massive rent extraction

2.6 Production Economy

Assume bankers face a concave production opportunity locus $F(e_{b1}, e_{b2})$

Proposition 5 (Rent Extraction with Production) *1. In a symmetric rent extraction equilibrium, bankers choose an endowment* $e_2 = 0$ *to maximize* e_1*.*
2. In a mixed-strategy rent extraction equilibrium, bankers reduce aggregate wealth in both states of nature.

Note: massively negative NPV production takes place

2.7 Financial Innovation

In this section we endogenize the market structure. We assume bankers can create a market between $s = 1, 2$ at a fixed cost f, as described for example in Allen and Gale (1988, 1991).

Proposition 6 (Financial Innovation and Rent Extraction) *Bankers are willing to pay a higher fixed cost* f *if they trade for rent extraction than if they would trade for insurance.*

In short: Financial innovation is most profitable if directed at rent extraction

Interpretation: financial innovation directed at creating an arbitrage opportunity

3 Applications

We now study a number of situations that capture circumstances in which the transfer rules described above may arise as equilibrium policies.

3.1 Pareto-Improving Bailouts

In our first application we study an economy with a combined banking/productive sector that interacts with households and a planner that lacks the power to commit. When the banking/productive sector experiences large losses, it can no longer perform its essential role in the production process, which depresses production and labor income. In such a situation, a planner finds it optimal to provide bailouts to bankers in order to stimulate the economy and increase labor income, even if they have made prior commitments to the contrary. This policy achieves a Pareto improvement.

Assume a modified setup of our benchmark model in which each state of nature s encompasses two periods. In the first period, market exchanges and potential transfers take place, as described in the previous section, and households and bankers end the period with net worth w_{si}. In the second period, households are endowed with one unit of labor each. Bankers invest their net worth as capital and combine it with one unit of labor hired from households to produce according to a Cobb Douglas production function $F(k,l) = k^a l^{1-\alpha}$. Observe that capital and labor are complements in this production technology.

We assume that bankers cannot borrow from households because they cannot commit to repay in the second period, and they also cannot commit to hire labor from a particular household in exchange for a transfer payment from this household. These assumptions lead to a market incompleteness that may make transfers a welfare-improving policy through a *market completion* effect.

Bankers maximize their final payoff $\pi = F(k,1) - w$, and the wage w satisifes

$$w = F_l(k,1), \quad \text{where} \quad \partial w / \partial k > 0,\ \lim_{k \to 0} \partial w / \partial k = \infty$$

The derivatives in this equation imply that workers earn higher wages when bankers are better capitalized, since the productive sector can produce more under such circumstances and pay higher wages. In particular, there is a threshold x such that $\partial w / \partial k > 1$ for $k < x$, i.e. if government transfers one additional unit of capital from households to bankers, the wage of workers will rise by more than one dollar. When this condition is met, bailouts constitute a Pareto improvement. In such a situation, democratic governments will find it difficult to resist the temptation to tax the endowment of workers and inject more capital into the banking system. Given this setup and lack of policy commitment, bankers rationally anticipate that the planner in the economy will follow a transfer rule t_x with x as defined above.

Given this setup, all our findings of the previous section apply. In particular, if transfers are uncompensated or insufficiently compensated, then bankers may follow a rent extraction strategy that allows them to extract a large share of the households' resources in some states of nature. On the other hand, if transfers are correctly compensated, then government transfers may insure bankers against inefficient fluctuations for which markets are nonexistant while ensuring that no rent extraction takes place.

4 Conclusion

This paper has analyzed the dual role of bailout transfers is substituting for incomplete markets and in distorting incentives. The distortive effects of transfers can be kept in check if they are compensated for by appropriate taxation. However, if no or insufficient compensating taxes are imposed, the possibility of bailout transfers in states that are linearly dependent with existing financial markets allows bankers to engage in rent extraction: they sell claims that pay out in states in which they receive bailout transfers since they do not need to worry about the downside of their investments in such states, and allocate their upside across the remaining states of nature. As a result, they can extract bailout rents from the rest of society and shift the average allocation of resources in their favor. A byproduct of such behavior is to increase the volatility of consumption across states of nature. Rent extraction is likelier the higher subsistence level guaranteed by bailouts, the lower the probability of the state of nature into which losses are shifted, and the lower the aggregate level of resources in the economy in such states are.

In the described setting, the distribution of resources between the financial sector and the real economy depends on the extent of financial innovation and financial regulation. Financial innovation redistributes towards the financial sector by increasing the share of resources extractable through bailouts, while financial regulation stems against this mechanism. In extreme cases, financial innovation can be directed solely at rent extraction.

Financial innovation and financial regulation are also likely to affect the real economy. Channeling capital into risky production projects is one of the ways in which the banking sector of an economy may engage in rent extraction through bailouts.

Finally, our paper labeled agents that were engaged in rent extraction as "bankers." This is natural since the financial sector typically has the best access to technologies that arbitrage across different states of nature. However, there are a number of other settings in which our framework applies and yields insights about the desirability of financial innovation, financial regulation, and the distribution of resources in the economy.

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A Mathematical Appendix

A.1 Proof of Proposition 4

(to be completed)