The Political Economy of Incentive Regulation: Theory and Evidence from U.S. States.

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To Enforce and Comply
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The New Theory of Regulation.

A long theoretical tradition (Laffont and Tirole, 1993; Laffont, 1996 and 2000; Laffont and Martimort, 1999; Boyer and Laffont, 2003) and a recent body of empirical research (Ai and Sappington, 2002; Eckenrod, 2006) have been focusing on the relative merits—rates and investment level—of differently powered:
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1. optimal incentive schemes should trade off informational rents extraction and cost-saving inducement;
2. performance based regulation (PBR, therein) can deliver lower rates and higher profits with no overall reduction in quality.
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- politicians care more or less about the firm’s profit depending on whether their constituency is dominated by pro-shareholder or pro-consumer sentiments;
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Research Objectives and Strategy.

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- a simple and general study case;
- bridge mechanism design and political economy.
The Study Case: the US Electric Power Market.

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- **Supervision—adversarial hearings**: in order to assure higher transparency, regulators and High Court judges only examine witnesses and experts, receive the evidence and interpret regulations; the final motion is proposed *de facto* by the PUC staff who acts as the jury in the anglo-american process (Gormley, 1983; CDRA, 1992).
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- The firm’s utility is \( U = t - \psi(a) \) where \( t \) are the managerial rewards and \( \psi \) with \( \psi' > 0, \psi'' > 0, \psi''' > 0 \) is the effort cost function. Define \( \Phi(a) \equiv \psi(a) - \psi(a - \Delta\beta) \). The IR constraint \( U \geq 0 \) is imposed. Thus, the ex-ante expected social welfare can be written as:

\[
W = V(q) - (1 + \lambda) [((\beta - a)q + \psi(a)] - \lambda U.
\]

where \( V(q) = (1 + \lambda)S(q) \).
The planner obtains two truthful and orthogonal signals whose precisions’ technology is multiplicative in each supervisor $i = E, A, l = J, R$’s effort $e_{i,l}^*$ and in the common random ability $\alpha \sim f$ with $\alpha \in [0, 1]$: $\xi_{i,l}^* = \alpha e_{i,l}^*$. 

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In particular, each signal is such that if the type is $\beta$ the planner is informed with probability $\xi^*_i, l$; when the type is $\bar{\beta}$, she always remains uninformed—the court wants to prove that the firm is indeed efficient.
Timing: Endogenous Division of Powers.

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3. The regulator chooses her level of effort; next, she discovers her random ability and, at last, the planner receives the first signal. If the latter is informative, the first best is implemented; if not:

4. The judge chooses her level of effort; next, she discovers her random ability and, at last, the planner receives the second signal.

5. If also this signal is uninformative, the planner asks the firm to report its information. Next, the firm exerts the equilibrium effort and the rewards-cost pair is implemented. Finally, the signals' precision are revealed and each supervisor receives her reward.
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Supervisors’ Incentives and Motivations: Framework.

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$$R_{i,l}(e_{i,l}, S) = \left\{ 1 + \left[ (1 - SR) G^i(e_{i,l}) - (1 - (1 - S) J) (1 - K) \tilde{C}(e_{i,l}) \right] \right\} r$$

$S = 1$ whenever $l = R$ and $0$ otherwise. Moreover:
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1. $R$ and $J$ are the *revolving door* and *fairness* parameters. These legacy-intrinsic motivations terms black-box wide strands of literature on bureaucrats and judicial attitudes (Gormley, 1983; Gennaioli and Shleifer, 2008);
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2. The rewards from implicit incentives $G^i(\cdot)$ are such that: $G^E(e_{E,l}) = \Pr\{\xi_{E,l} \geq \xi^*\}$ and $G^A(e_{A,l}) = E[E(\alpha/\xi_{A,l})]$ (Alesina and Tabellini, 2007);
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3. $\tilde{C}(\cdot)$ is the supervisors’ effort cost function and $K$ an efficiency of the information-gathering technology parameter.
The Planner’s Problem.

Define the ex-ante expected probability of at least one informative signal as

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The planner’s objective function is:

\[ \tilde{W}^s = v\gamma (i,j) W^* + \]
\[ + [1 - v\gamma (i,j)] \left\{ \frac{v [1 - \gamma (i,j)]}{1 - v\gamma (i,j)} \left[ V (\bar{q}^s) - (1 + \lambda) \left[ (\beta - \bar{a}^s) q^s + \psi (q^s) \right] - \lambda \Phi (\bar{a}^s) \right] \right\} \]
\[ + \frac{1 - v}{1 - v\gamma (i,j)} \left[ V (\bar{q}^s) - (1 + \lambda) \left[ (\bar{\beta} - \bar{a}^s) \bar{q}^s + \psi (\bar{a}^s) \right] \right] - 2 (1 + \mu) r \]
Static Efficiency: LEMMA.

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Thus, in a PBE, the level of prices and the power of the contract are determined by the low type effort:

\[
\psi'(\hat{a}^s) = \hat{q}^s - \frac{\lambda}{1+\lambda} \Gamma(v) \left[ 1 - \gamma(i,j) \right] \Phi'(\hat{a}^s),
\]

where the rent \( \Phi(a) \equiv \psi(a) - \psi(a - \Delta \beta) \) has \( \Phi' > 0, \Phi'' > 0 \).
Static Efficiency: Proposition 1.

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Remark 1: Two extents of complementarities: the political (in the spirit of Gibbons and Murphy, 1992) and the technological one.

Remark 2: Endogenous collusion proofness coherently to Ka and Teske (2002).
Dynamic Efficiency: Proposition 2 and 3.

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Dependent Variable:

1. \( \text{PBR}_i, t \) equal 1 in state \( i \) and year \( t \) if cost of service was in place, 2 if rate case moratoria or revenue sharing was employed and 3 if a price cap was used.

2. \( \text{PBR}_i, t \) equal 1 if a PBR contract was in place in state \( i \) in year \( t \).
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Non Random Incentive Rules Selection.

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- Want to identify the relevant determinants of the relative power of the incentive scheme in place. Use the following ordered logit:

\[
Pr(y_{i,t} = k | z_{i,t}) = \Lambda(\tau_k - \beta' z_{i,t}) - \Lambda(\tau_{k-1} - \beta' z_{i,t}) \quad \text{for} \quad k = 1, 2, 3
\]

with \( k = \) power levels, \( i = \) states, \( t = \) time-years, \( \tau_k = \) unknown threshold parameters, \( \Lambda = \) logit function and \( y_{i,t} = PBR_O \).
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- Want to identify the relevant determinants of the PBR introduction timing. Use the following exponential proportional hazard rate model:
  \[ \lambda(t, z_{i,t}) = \exp(\beta' z_{i,t}) \lambda_t^* \]
  with \( \lambda_t^* = \) baseline hazard and \( z_{i,t} = PBR \). Notice that a coefficient greater than one implies higher odds that an individual in the treatment group implements the reform before one in the control group.
Choosing Proxies.

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- *Budget* is a raw proxy for more resources to allocate in information-gathering;

- While *Price_R(-2)* is linked to more costly production structure, *Rep* summarizes the planner’s tastes.
### Non Random Incentive Rules Selection

<table>
<thead>
<tr>
<th></th>
<th>PBR_O</th>
<th>PBR_O=3</th>
<th>PBR</th>
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<tbody>
<tr>
<td><strong>Reg_Elec</strong></td>
<td>2.353</td>
<td>0.055</td>
<td>5.328</td>
</tr>
<tr>
<td></td>
<td>(0.368)**2</td>
<td>(0.013)**</td>
<td>(3.417)**</td>
</tr>
<tr>
<td><strong>Jud_Elec</strong></td>
<td>0.080</td>
<td>0.001</td>
<td>0.562</td>
</tr>
<tr>
<td></td>
<td>(0.298)</td>
<td>(0.003)</td>
<td>(0.315)</td>
</tr>
<tr>
<td><strong>Rev_Door</strong></td>
<td>-0.893</td>
<td>-0.011</td>
<td>0.554</td>
</tr>
<tr>
<td></td>
<td>(0.345)**3</td>
<td>(0.005)**</td>
<td>(0.407)</td>
</tr>
<tr>
<td><strong>Jud_Term</strong></td>
<td>-0.082</td>
<td>-0.0008</td>
<td>1.106</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.0007)</td>
<td>(0.116)</td>
</tr>
<tr>
<td><strong>Budget</strong></td>
<td>0.00002</td>
<td>2.08E^{-07}</td>
<td>1.00001</td>
</tr>
<tr>
<td></td>
<td>(4.47E^{-06})**3</td>
<td>(0.00000)**</td>
<td>(4.44E^{-06})**</td>
</tr>
<tr>
<td><strong>Price_R(-2)</strong></td>
<td>0.428</td>
<td>0.004</td>
<td>0.878</td>
</tr>
<tr>
<td></td>
<td>(0.159)**3</td>
<td>(0.002)**</td>
<td>(0.188)</td>
</tr>
<tr>
<td><strong>Republican</strong></td>
<td>0.073</td>
<td>0.0007</td>
<td>0.625</td>
</tr>
<tr>
<td></td>
<td>(0.351)</td>
<td>(0.004)</td>
<td>(0.446)</td>
</tr>
<tr>
<td><strong>Majority</strong></td>
<td>2.527</td>
<td>0.025</td>
<td>6.281</td>
</tr>
<tr>
<td></td>
<td>(1.416)</td>
<td>(0.013)**</td>
<td>(15.581)</td>
</tr>
<tr>
<td><strong>PBR_Nei</strong></td>
<td>0.328</td>
<td>0.003</td>
<td>7.779</td>
</tr>
<tr>
<td></td>
<td>(0.956)</td>
<td>(0.010)</td>
<td>(12.637)</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>7.17E^{-08}</td>
<td>7.22E^{-10}</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(2.72E^{-08})**3</td>
<td>(0.00000)**</td>
<td>(2.71E^{-08})*</td>
</tr>
<tr>
<td><strong>GSP</strong></td>
<td>0.0001</td>
<td>1.02E^{-06}</td>
<td>1.0002</td>
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<tr>
<td></td>
<td>(0.00004)**3</td>
<td>(0.00000)**</td>
<td>(0.00007)**</td>
</tr>
<tr>
<td><strong>Estimation</strong></td>
<td>Ordered logit (coefficients)</td>
<td>Ordered logit (marginal effects)</td>
<td>Exponential survival (hazard ratio)</td>
</tr>
<tr>
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<td>Ordered logit (coefficients)</td>
<td>Ordered logit (marginal effects)</td>
<td>Exponential survival (hazard ratio)</td>
</tr>
<tr>
<td>Log Pseudolikelihood</td>
<td>-183.300</td>
<td>-183.300</td>
<td>-22.365</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.25</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
<td>736</td>
<td>736</td>
<td>692</td>
</tr>
</tbody>
</table>

---

1 Robust standard errors (z distribution) in parentheses;
2 *** denotes significant at the 1% confidence level; **, 5%; *, 10%.
Non Random Incentive Rules Selection.

<table>
<thead>
<tr>
<th>Variable</th>
<th>PBR_O=3</th>
<th>PBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg_Elec</td>
<td>0.055</td>
<td>5.328</td>
</tr>
<tr>
<td></td>
<td>(0.013)<strong>3</strong>*4</td>
<td>(3.417)**</td>
</tr>
<tr>
<td>Jud_Elec</td>
<td>0.001</td>
<td>0.562</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.315)</td>
</tr>
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Estimation: Ordered logit (marginal effects) Exponential survival (hazard ratio)

---

3 Robust standard errors (z distribution) in parentheses;

4 *** denotes significant at the 1% confidence level; **, 5%; *, 10%.

5 Robust standard errors (z distribution) in parentheses;

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## Non Random Incentive Rules Selection

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<tr>
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<td>$7.22E^{-10}$ (0.0000)***</td>
<td>$1$ (2.71E^{-08})*</td>
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<tr>
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<td>1.0002 (0.00007)**</td>
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<table>
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**Take Home Idea:** PBR reforms were not random but mainly guided by efficiency and political forward-looking factors as predicted by the model.

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Endogeneity: states may well self select into PBR on the bases of unobserved shocks affecting at the same time, for instance, the cost structure and the political saliency of the reform.
Therefore, when assessing the impact of PBR on performances, need to measure the truly exogenous variation in institutions. Strategy:

\[ y_{si,t} = \eta_i + \vartheta_t + \theta y_{si,t-1} + \phi PBR_i,t + \psi X_{i,t} + \epsilon_{i,t}, \]

where \( y_{si,t} \) is a price for ratepayers class \( s \); \( X_{i,t} \) gathers the time-varying determinants of incentive rules, a fossil fuels cost index \( c \) and other controls.

Remark: treat both PBR and \( c \) as endogenous and \( y_{si,t-1} \) as predeterminated.

Both prices and marginal costs are autoregressive of order 1. An extra exogenous instrument is:

\[ PBR_{-Nei} \] (Steiner, 2004).

Therefore, when assessing the impact of PBR on performances, need to measure the truly exogenous variation in institutions. Strategy:

Use the Arellano and Bond difference GMM estimator to estimate:

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## Incentive Rules and Regulated Rates: Results.

<table>
<thead>
<tr>
<th></th>
<th>Price(_R)</th>
<th>Price(_C)</th>
<th>Price(_I)</th>
</tr>
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<tbody>
<tr>
<td><strong>PBR</strong></td>
<td>0.126</td>
<td>-0.100</td>
<td>0.093</td>
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<tr>
<td></td>
<td>(0.214)</td>
<td>(0.163)</td>
<td>(0.139)</td>
</tr>
<tr>
<td><strong>Other Controls</strong></td>
<td>Reg(<em>\text{Elec}), Jud(</em>\text{Elec}), Budget, Republican, Majority, Population, Young, Old, GSP.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Predetermined</strong></td>
<td>LaggedDependentVariable</td>
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<tr>
<td><strong>Endogenous</strong></td>
<td>c, PBR</td>
<td></td>
<td></td>
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<tr>
<td><strong>Instruments (collapsed)</strong></td>
<td>One lag of dependent and c, PBR(_\text{Nei})</td>
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<tr>
<td><strong>Estimation</strong></td>
<td>Fixed state and time effects difference GMM estimator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruments Count</td>
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<td>28</td>
<td>28</td>
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<tr>
<td>Autocov. of order 2</td>
<td>0.74</td>
<td>0.54</td>
<td>0.68</td>
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<td>Hansen test for overid.</td>
<td>0.90</td>
<td>0.46</td>
<td>0.67</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>644</td>
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Three Main Contributions.

1. The paper formalizes and tests a theory of complementarities among supervisors’ implicit and firms’ explicit incentives arising from the contractability of the firms’ allocation as opposed to the non-contractability of supervisors’ effort.
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2. Endogenous Collusion Proofness.

3. First empirical analysis of the efficiency and strategic political determinants of incentive regulation and the first test of the endogenous impact of incentive rules on prices: the reforming wave was mainly aided to repay sunk investments.
Advices for Constitutional Designers.

1. It is crucial to assess the dynamic effects of more powerful rules when expropriation of sunk investment is a concern;
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2. Before calibrating the power of the explicit incentives to be imposed on the regulated firm, the efficiency of the information-gathering technology and the broad set of concerns to which supervisors respond need to be considered attentively;

3. The success of regulatory regime reforms cannot abstract from a Constitutional table insulated from short-term electoral boosts.
Accountability in Government and Regulation Policy.

Guerriero (2008) focuses on a simplified version of the model in order to characterize the optimal selection of supervisors’ implicit incentives problem. Main Results:
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The Complementarities Patterns.

\[ F = \beta - a^*, \quad F' = \bar{\beta} - a^*, \quad F'' = \bar{C} = \beta - \hat{a} \]
Follow Alesina and Tabellini (2008) and assume that supervisors have two tasks and a lobby interested in maximizing the firm’s rent can offer to each supervisor a side contract–illegal bribes or legal campaign funds–conditional on the effort exerted in the other activity–e.g., avoiding by-passing.
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In the background:

1. The technology of the second task is \( h_{i,l} = \alpha e^{h}_{i,l} \) and its benefits are negligible for consumers and \( \kappa h_{i,l} \) with \( \kappa > 0 \) for the firm;
Endogenous Collusion Proofness: Set Up.

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  2. $\alpha$ is now truncated normally distributed;
  3. The planner cannot condition her choice—i.e., incentive schemes—on the supervisors’ collusive activities.
Endogenous Collusion Proofness: Results.

1. Appointed supervisors:
   - For sufficiently strong non-monetary incentives, supervisors never accept bribes; at the same time, the lobby prefers to be ex-ante passive if the firm’s stake is too narrow or legal systems work efficiently.
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Proposition 2.

Laffont and Tirole (1993): whether or not the planner can commit to reimburse investment costs, the equilibrium can envision ex post expropriation of sunk investments, being the investment return partly extracted along with the informational rent.
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- **Result**: if, before learning $\beta$, the firm can commit a monetary investment increasing the ex ante probability of being a high type, in equilibrium the degree of under-investment is higher the more powerful is the incentive rule. Therefore, a benevolent planner should rise the power of the incentive rule the more relevant are investment concerns (see also Sappington, 1986).
Proposition 3: the Investment Game.

Suppose that:

1. the incentive rule is selected in stage 2 by the incumbent between two parties: the pro-shareholder $R$ and the pro-consumer $D$. 
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2. Add to the usual timing two more steps: 6. An election with exogenous winning probability $x_m, (m = D, R)$ is held; and the winner can, exerting the costly effort $\rho_m$ with $\rho_R > \rho_D > 1$, ease the firm’s private-funds-seeking activity; 7. the firm can commit to an investment with fixed monetary cost $\bar{I} \geq 0$ and stochastic return whose expected value is $\pi \equiv \bar{\pi} \delta + \bar{\pi} (1 - \delta) > 0$ with $\bar{\pi} > 0 > \pi$ and $\delta > 0$. 
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The firm is infinitively risk averse in the range of the ex-post negative utilities so that only the high type invest if:

$$\Phi \left( \bar{a}_{\bar{m}}^{S,F} \right) + \bar{\pi}\bar{I} \geq 0$$

where $\bar{m} = D, R$. 
Proposition 3: Results.

- Each party evaluates the ex-post participation to the investment game constraint at both the common shadow price $o > 0$ and a specific investment concern $\chi_m$—the party’s willingness to leave higher ex post rents to shareholders—with:

$$\chi_R \equiv 1 + o - \gamma < 1 + o + \gamma \equiv \chi_D, \quad \gamma > 0 \text{ and } \bar{x} < \lambda/\gamma$$
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- Therefore, the incumbent maximizes:

  $\tilde{W}_m^{S,I} = \tilde{W}^S + (1 + o - \chi_m) \tilde{x} v [1 - \gamma (i, j)] \Phi \left( \tilde{a}_m^{S,I} \right)$
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  \]

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  \[
  \tilde{W}^S = \tilde{W}^S + (1 + o - \chi_m) \tilde{x} v [1 - \gamma (i, j)] \Phi \left( \tilde{a}^S_m \right)
  \]

- All in all, the equilibrium low type’s allocation is:
  \[
  \psi' \left( \tilde{a}^S_m \right) = \tilde{q}^S_m - \Gamma (v) [1 - \gamma (i, j)] \left[ \frac{\lambda}{1 + \lambda} - \frac{1 + o - \chi_m}{1 + \lambda} \tilde{x} \right] \Phi' \left( \tilde{a}^S_m \right),
  \]
  which, in turn, implies Proposition 3.