

Full Versus Binary Menus: What are the Welfare Gains?

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Motivation

- Regulation of monopolies under asymmetric information.
 - The regulator delegates a task to a firm. Objectives and cost reimbursement rules are specified in a contract.
 - The principal does not observe the cost characteristics nor the cost reducing effort of the operator.
 - Maximizes social welfare under an incentive compatible constraint. Revelation principle.
- Laffont and Tirole (1986): The second-best solution can be decentralized through a menu (a continuum) of linear contracts.
 - The operator picks up the contract which corresponds to its real “type”.
 - Fixed-price and cost-plus contracts are two extreme cases.

Motivation

- Ongoing debate between positive and normative analysis.
- Full menus are difficult to implement in reality
 - The regulator needs to be able to specify the agent's disutility function.
 - Calculating the optimal menu is technically complex.
- Binary menus are frequent:
 - US Department of Defense and weapons contractors.
 - Federal Communications Commission and Regional Bell Operating Companies.
 - Nonlinear pricing in product markets (Wilson 1993).
 - Construction industry (Bajari Tadelis, 2001).
 - Urban transportation in France (Gagnepain Ivaldi 2002).

Motivation

- Menus of 2 contracts:
 - Are easy to understand and calculate.
 - Have lower informational requirements. The principal should be able to
 - describe the likely distribution and density of costs.
 - evaluate the efficiency gains to be obtained if fixed-price instead of cost-plus.
 - The principal guarantees that all types of the agent participate by offering a cost-plus.
 - It extracts rent and create incentives for the low-cost types using a fixed-price.

Motivation

- Rogerson (2003) (Chu and Sappington, 2007, as well): Simple menus of cost-plus and fixed-price contracts.
- Capture a substantial share of the gains achievable by the fully optimal menu: At least 75%.
- Theoretical exercise.
- Initial assumptions: Agent's disutility of effort quadratic and agent's type is distributed uniformly.

Two main objectives

- Challenge Rogerson's results through an empirical test.
 - The French urban transport industry.
 - Currently: Binary menus of cost-plus and fixed-price contracts.
 - The ingredients of the industry are known already (Gagnepain Ivaldi Martimort, 2010).
 - Simulate the welfare gains that could be obtained if a full optimal menu is implemented instead.
- Investigate whether the major source of benefits in contract design comes either from extending contract length or from better designing cost reimbursement rules.
 - By how much can welfare be improved if the regulator can commit perfectly to the same contract over time (Gagnepain Ivaldi Martimort, 2010)?
 - Compare both simulations.

Two main objectives

Perfect commitment
(Normative framework)

Limited commitment
(Positive framework)

Binary menu

Gagnepain Ivaldi Martimort (2010)

Conditional on Φ^{LC}

Welfare W^{FM}

Binary menu

Gagnepain Ivaldi Martimort (2010)

Characteristics Φ^{LC}

Welfare W^{LC}

Full Menu

This article

Conditional on Φ^{LC}

Welfare W^{BM}

The Industry

- Light vehicles (buses).
- Each urban area: One operator, one public authority.
- Adverse selection and moral hazard.
- Two types of contracts: Cost-plus and Fixed-price.
- Operator chooses contract inside menu.
- Length: 5-6 years on average.

Binary menus

- Preferences of the government: $W = S - (1 + \lambda)t + \alpha U$
- Contracts: $t \in \{c, b\}$
- Costs of the operator: $C = \theta - e$
- Inefficiency: $F(\cdot), [\underline{\theta}, \bar{\theta}], R(\theta) = \frac{F(\theta)}{f(\theta)}$
- Effort: $\psi(e)$

Binary Menus

- The principal offers a long-term contract.
- *FP* contract is defined by b_1 and b_2 .
- First best effort: $\psi'(e^*) = 1$
- Net social value of effort: $k = e^* - \psi(e^*)$
- Intertemporal Payoff of the operator:
$$\beta b_1 + (1 - \beta)b_2 - \theta + k$$
- Cost-plus contract implies no effort and profit is 0.

Binary Menu

- Only the most efficient types choose the *FP* contract:

$$\theta \leq \beta b_1 + (1 - \beta)b_2 + k = \theta^*$$

- The optimal *FP* contract is the repeated version of the static optimal contract.
- A measure of welfare is:

$$W^{FC} = S - (1 + \lambda) \left(b_F F(\theta^*) + \int_{\theta^*}^{\bar{\theta}} \theta f(\theta) d\theta \right) + \alpha \int_{\underline{\theta}}^{\theta^*} (\theta^* - \theta) f(\theta) d\theta$$

Full Menu

- The regulator proposes a complete menu of contracts to the operator:

$$1 = \psi'^{SB}(\theta)) + \left(1 - \frac{\alpha}{1 + \lambda}\right) \frac{F(\theta)}{f(\theta)} \psi''^{SB}(\theta))$$

- The Second-best effort is $e^{SB}(\theta) = 2k - \left(1 - \frac{\alpha}{1 + \lambda}\right) \frac{F(\theta)}{f(\theta)}$
- Welfare:

$$W^{SB} = S - (1 + \lambda) \left(\int_{\underline{\theta}}^{\bar{\theta}} (\theta - e^{SB}(\theta) + \psi(e^{SB}(\theta))) f(\theta) d\theta \right) + \alpha \int_{\underline{\theta}}^{\bar{\theta}} \psi'^{SB}(\theta)) f(\theta) d\theta$$

(preliminary) Empirical results

- Binary menu captures 27.7% of the welfare achievable by the fully optimal complex menu.
- Ability to design good cost reimbursement rules is important :
 - Welfare increases by 5.5 million Euros if full menu in place of binary menu.
 - Welfare increases by 1.9 million Euros if perfect commitment instead of limited commitment.
- Further analysis is needed. In particular, test
 - Alternative distributions for $\psi(e)$.
 - Other specifications for $F(\theta)$.