Topic 8, Ec 428, 2009, Prof. M. Ghatak

Industrial Organization in Developing Countries

International productivity differences: role of orgn. structure

Why don't resources (capital, technology, skills) flow from rich to poor countries? Doing business is more difficult in developing countries

- Excessive regulation, poor infrastructure
- Poor institutions for contract enforcement
- Uncertainty (caused by poor infrastructure, erratic policy environment, missing markets)

Plan of today's lecture:

1. Assess how important is regulation for industrial performance – Besley-Burgess QJE 2004 study of labour regulation in India
2. Examine how the industrial organization of developing countries deals with these problems. Study some aspects of IO in developing countries.

2a. Importance of reputation in contracting (Banerjee-Duflo, 2000).

- Older and bigger firms enjoy high profits
- Trading within social networks and business groups
- Creates barriers to entry, misallocation of capital, and limits the expansion of trade

2b. Industrial subcontracting (Andrabi, Ghatak, Khwaja, 2002).

- Clusters of small and medium firms that are spatially concentrated and specialized in specific industries.
- Suppliers provide specialized inputs to several buyers selling related but different products and buyers have more than one supplier for the same input.
- Flexible specialization
- Optimal response to uncertainty and costly capacity-building or inventory-holding (imperfect credit markets make investing in capacity costly

1. The Besley-Burgess (QJE 2004) Study on Labour Regulation in India

• If you wish to set up a new business, the time it will take you to get all the clearances and get started is

- ○ 8 days in Singapore
- ○ 11 days in Hong Kong
- ○ 88 days in India
-

• If, after you do get started, your firm runs into a dispute over contract violation, the time that it will take to have the contract enforced is

- ○ 50 days in Singapore.
- ○ 180 days in Hong Kong ○ one year in India
-

• But the real catch in India is not with starting or running a business. It is with getting out of it. If a firm becomes insolvent the time it takes to liquidate is one year in HK, 7 months in Singapore & 11 years in India

• Ostensible reasons for having regulation is to protect organized sector workers

• Does it distort industrial organization & depress growth?

• Besley & Burgess look at the Industrial Disputes Act of 1947 – the centre passed it, but states have the right to amend it to facilitate implementation or suit it to local conditions

• Period under study 1958-92. Code these amendments are pro-worker, neutral, pro-business

• This measure of regulation strongly correlated with measures such as workdays lost due to strikes or lockouts

• Estimated equation:

$$y_{st} = \alpha_s + \beta_t + \mu r_{st-1} + \gamma x_{st} + \varepsilon_{st}$$

• Find that regulation measure has reduced manufacturing output per capita (Table III columns 5-7)

• Interesting composition effect: has shifted activity from registered to unregistered manufacturing (which are not subject to labour regulation)

• Controls: r could pick up effect of other policies so control for rural development expenditure (measure of human capital & infrastructure investment by govt), electrical capacity per capita.

• Also control for political composition of state legislature & find that greater left control has a negative effect on mfg growth but labour regulation measure is still negative & significant

• Endogeneity: regulation is endogenous

• Same factors that drive these policies could be correlated with negative productivity shocks

• States that passed the more pro-worker amendments had higher mfg output per capita in 1960 than the other states

• Could be that these states had more powerful union presences

• Instrument: in 1977 there was country-wide change in political regime with the main ruling party defeated in most states & some of the left parties came to power

• Interact union membership with a dummy that is 0 for pre 1977 & 1 for post 1977

• Idea: the political regime shift was exogenous to the state's industrial climate, but those with powerful unions took the opportunity to pass pro labour amendments

• Unlikely to be correlated with anticipated prod. shocks

• Results remain similar

2a. The Banerjee-Duflo (QJE 2000) Study of Indian Software Industry

Information on 125 software companies in three major "software cities" in India & their last two projects

Indian software industry produces mainly customized software

- Software is a complex product & takes time to produce
- Specific to the client.
- Difficult to write detailed contacts specifying the nature of the final product that can be enforced by third parties.
- Buyer worries that it will take longer & cost more than promised
- At the outset neither the client nor the firm entirely understands all aspects of the good to be delivered.

- While a budget is prepared, overruns (defined as the difference between the estimated costs and realized costs) are frequent.
- Both sides can claim the other side is to blame (supplier was inefficient, or client changed specification mid way)
- Contracts tend to be very simple
    - a rough description of the software needs of the buyer (the project)
    - the price to be paid by the buyer when the software is delivered
    - a cost estimate by the seller
    - fraction of cost overruns (i.e., the actual cost minus the cost estimate) to be borne by the seller.
- Contracts are typically either “time and material” (15% in the sample) or `fixed price' (58%) or a combination of the two (27%)

- Figure 1 we see that the higher is the age of the firm, the less likely it is to get fixed price contracts.
- Figure 2 shows that the share of overruns borne by the firm is decreasing in the age of the firm.
- In Table II, these findings are supported. Moreover, it is shown that measures of reputation are not significantly correlated with performance, e.g., total overruns, total overruns due to the firm.

Theoretical Argument

- According to BD, young firms are given ``tough'' contracts and old firms are given ``nice'' contracts because of reputational reasons.
- This model predicts that younger firms get more fixed price contracts and pay a higher share of overruns
- However, since the screening by the client is successful by design, the performance of young firms should be no different from old firms

- Let F be the fixed price & s be the share of overrun to be borne by seller
- Let y denote young sellers & o denote old sellers
- Screening contract (F_y,s_y) & (F_o,s_o)
- Overruns take two values, 0 & D
- Two types of sellers in the population, high & low
- Their probabilities of not incurring overruns are p_h & p_l
- Incentive-compatibility constraint: aim is low types don't accept:

$$p_l u(F_y) + (1 - p_l)u(F_y - s_y D) + \delta\Pi^* \leq \bar{u}(1+\delta)$$

- Π^* is expected payoff of an old firm:

$$\Pi^* = p_h u(F_o) + (1 - p_h)u(F_o - s_o D)$$

- $\bar{u}$ is the outside option
- Have to make sure that young high types accept:

$$p_h u(F_y) + (1 - p_h)u(F_y - s_y D) + \delta\Pi^* \geq \bar{u}(1+\delta)$$

- By design low types don't accept so know for sure that old sellers are high types, & so offer them nicer contracts

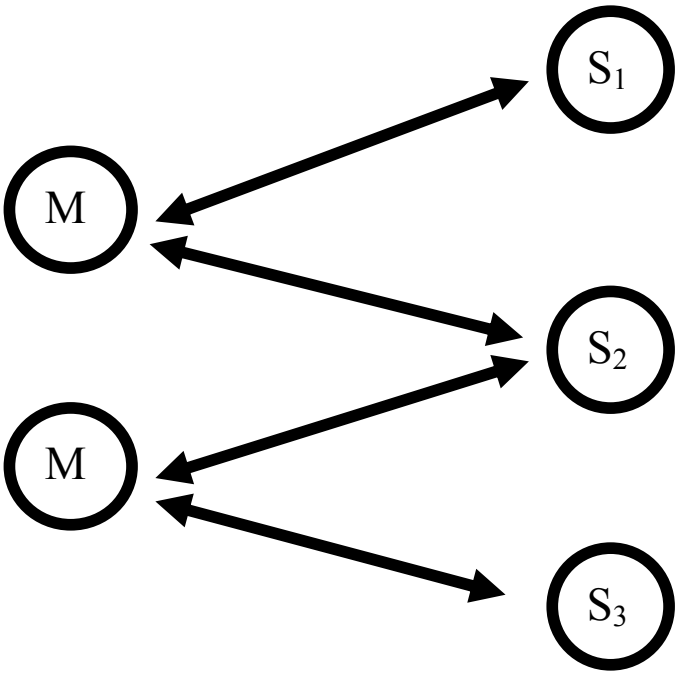
- A learning-by-doing type story would imply young firms being inexperienced, have more overruns but evidence suggests actual performance uncorrelated with age
- If there were no informational problems, a pure risk-sharing story would imply that younger firms should be given more insurance since they tend to be smaller and more risk averse. Once again the descriptive statistics do not support this.
- BD test if the same results can be obtained if one controls for other firm characteristics (firm size, whether they have done business with the current buyer before), project characteristics (size measured by estimated cost of the project, type of the project, such as Y2K protection, data analysis etc.), client characteristics (e.g. size).
- A contract takes the value 1 if it is fixed price, 2 if it is mixed and 3 if it is a time and material contract. #

- Their main findings are as follows - holding project and buyer characteristics constant

1. Young supplier firms are significantly more likely to receive fixed price contracts, and also bear a substantially higher fraction of overruns on average.
2. Repeated relationships are associated with ``better'' contracts.
3. If a supplier has done business with the current buyer before, they are less likely to get fixed price contracts but this effect is not significant.
4. But interacting this variable with age, it is found that young firms that are in a repeat business with a buyer are significantly less likely to get fixed price contract.
5. This effect, while in the same direction, is not significant for old firms in a repeat business.
6. Finally, neither client overrun nor overrun due to the firm are correlated with the reputation of the firm.

2b. Andrabi-Ghatak-Khwaja (2004) Study on Subcontracting in Pakistan Tractor Industry

- Integrate vertically or buy from the market?
- The "make or buy" dichotomy unsatisfactory to understand manufacturer-supplier networks
    - Neither vertically integrated nor independent buyers/sellers. Manufacturers have several suppliers providing *specialized* inputs, & suppliers have several clients
    - Suppliers invest in flexible capacity (Piore & Sabel). Driven by uncertainty. Below S_2 has flexible capacity, but S_1 & S_3 are specialized:



Two main questions

- How do suppliers supplying the same part who differ in terms how specific their assets are with respect to one buyer vary in terms of
  - Prices
  - Distribution of orders

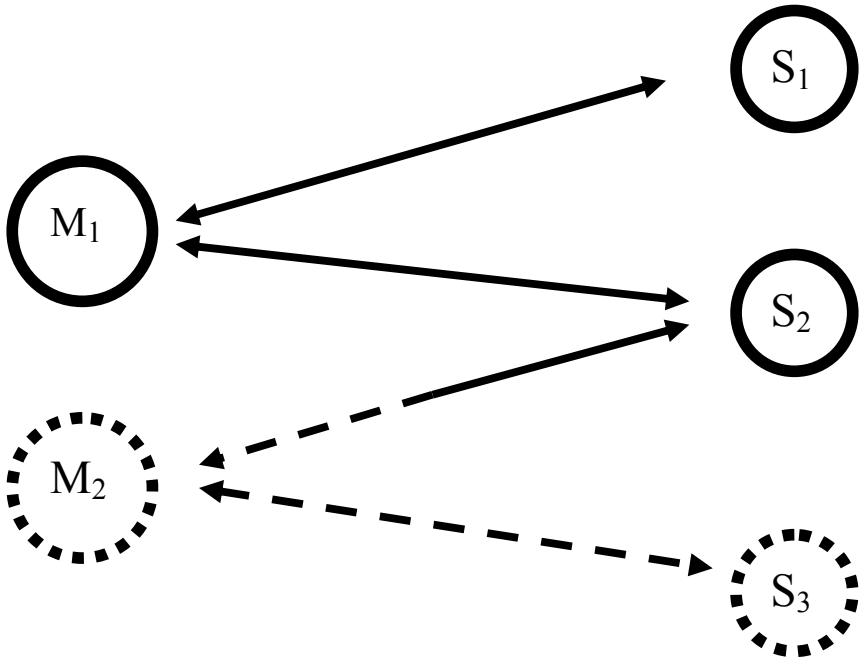
- What governs the variation in how specific a supplier's assets are in relation to one buyer?

  - Existing literature treats specificity as being driven purely by technology.
  - In our setting specificity is a choice & is likely to reflect supplier heterogeneity – the more versatile you are the less you are likely to tie yourself to one particular buyer
  - How does this selection bias affect our interpretation of effect of specificity on dependent variables?

What we do

- Develop a simple theoretical model which analyzes the costs & benefits of undertaking relationship-specific investments in an uncertain environment & how these are likely to vary among suppliers with heterogeneous qualities.

- Examine a detailed primary data set of contracts between one large buyer Millat Tractors Limited (MTL), the largest tractor-producing firm in Pakistan, & its suppliers. We also have information about the extent to which the assets of the suppliers are dedicated to MTL.



Institutional Environment

- MTL receives blueprints from its collaborator, Massey-Ferguson for two tractor models - R&D not important
- MTL (called the "**assembler**") subcontracts the production of most parts to local suppliers (called "**vendors**"): MTL itself manufactures only 7 of its 500 tractor parts in-house.
- In the past thirty years, MTL has developed a stable vendor base with 200 total vendors. Our sample consists of 28 randomly selected vendors from this base.
  - Each part has more than one vendor (same as in Japan auto-industry)
  - Vendors (generally) supply several MTL products
  - Vendors supply to other buyers (other assemblers, replacement market, automobile market)
- Features of environment
  - High uncertainty in yearly sales due to changes in govt. policy & agri. fluctuations (Figure 1)
  - Weak legal system

- Vendor characteristics are known to MTL: Rigorous selection & screening process, technical support. Most vendors old (mean age 15 at time of survey, & 80% established in the 80s)

- Vendor shown imported sample of part, & has to undertake some specific investments to be able to produce it
  - Physical capital (e.g., tooling equipments for specific uses – can choose more "flexible process")
  - Human capital (e.g., training for particular skills, management practices)

- After sample is approved, price is negotiated.
- Annual contracts issued
  - Negotiate & commit price (indept. of volume of orders)
  - Price renegotiated if significant cost shock (oil, steel)
  - Rough estimate of orders given but not committed
  - Quarterly orders issued depending on demand

- Other than cost, two aspects of a vendor's performance MTL is most concerned about
  - Timely delivery
  - Defect free delivery
- Future contracts (esp. level of future orders) sensitive to current performance but little evidence for vendors being fired

Empirical Findings & Key Questions

- Finding: Multiple active vendors for each part.

- *Question*: Why buy from several vendors?
    - Capacity constraints or diminishing returns
    - Guarantee against supply bottlenecks

- Finding: Significant contractual variation
    - **Price** offered to different vendors for the same part & in the same year differs significantly (on average 25%).
    - Some vendors receive a higher & more stable level of **orders** from MTL than others. First-preference & second-preference vendors. Same phenomenon seen in Japanese auto-industry.

- *Question*: Why buy from the more expensive vendor at all?
    - Capacity constraints facing the cheaper vendor
    - Better quality

- *Question*: Why this particular pattern of orders & what type of vendor is picked as first-preference?

- *Finding*: Controlling for age & size vendors with greater asset-specificity *vis a vis* MTL have lower unit costs & receive lower prices. However, they are treated as marginal suppliers, & have significantly higher excess capacity.

- *Question*: Why doesn't the assembler make vendors with more specific assets the first-preference vendor since they are cheaper?
    - Must be unattractive in some other dimension. Quality?

- Finding: Indeed they tend to perform worse in several dimensions
    - Timely delivery
    - Defect-free parts

- *Question*: But then why deal with them at all? Why not instead induce high quality vendors to have specific assets since that reduces costs?

Need a theory of costs & benefits of making specific investments, how this varies with vendor quality, & what prices & distribution of orders we see in equilibrium.

Specific investments

- Lead to lower costs & better quality within a relationship
- Worsens outside options by lowering flexibility which is costly when demand is uncertain
- Cost is higher for higher quality vendors

Even if a buyer prefers high quality suppliers, some low quality suppliers might be kept as marginal suppliers because of their greater willingness to invest more in assets specific to the buyer

Theory

Suppose there are many vendors of different quality. How would an assembler allocate its orders in a stochastic environment with costly storage? Is having first preference & second preference vendors optimal?

Will it choose only high types or will it choose both high & low types? Who will be first-preference?

What will be the pattern of asset specificity among vendors?

Model

- All parties are risk-neutral.
- Assembler faces stochastic demand for its specialized product - high (**2**) or low (**1**) with probability **α** & **1-α**
- Vendors can be of two *observable* types, high ($\bar{\theta}$) or low ($\underline{\theta}$) with $0 \le \underline{\theta} < \bar{\theta} \le 1$ & $\underline{\theta} + \bar{\theta} = 1$
- Relationship specific investment (**x**)
- **θ** & **x** increase surplus *inside* the relationship
- Assembler's expected payoff from a unit of the input: $\mathbf{V(x,\theta) = a + b\theta + c_0 x,\ a > 0,\ b > 0,\ c_0 > 0}$

- Constant unit cost of producing a part: $\gamma(x) = 1 - c_1 x$
- Each vendor has a *capacity constraint* of **1 :** do not model why there are multiple vendors, only their composition in terms of quality & asset specificity
- Cost of relationship-specific investment $c(x) = \frac{1}{2} x^2$
- Vendor's outside option increases with θ but decreases in **x** & the marginal decrease is higher the higher is θ

  $u(x,\theta) = \theta(1 - ux), \quad 0 \le u < 1$
- Can allow x,θ in $V(x,\theta)$ or $\gamma(x)$. Consider this later.

Gross ex post surplus

$S = V(x,\theta) - \gamma(x) = a + b\theta - 1 + \gamma x, \gamma = c_0 + c_1 < 1$

Assumption 1: $a + b\theta - 1 > \theta$ for both $\underline{\theta}, \bar{\theta}$ (Always beneficial to trade even if x=0)

Specific Investment is Contractible

- Let $\beta \in [0,1]$ be the demand faced by a vendor
  - Probability with which it is asked to supply 1 unit
  - Physical amount of the input
- **x** is chosen to maximize *ex ante* expected joint surplus within the relationship of type θ vendor & assembler

  $$\mathbf{s(x) = \beta * (V(\theta,x) - \gamma(x)) + (1 - \beta) * u(x, \theta) - c(x)}$$
- Optimal choice of **x** by vendor of type θ with order β

  $$\mathbf{x^*(\beta, \theta) = max \{\beta\gamma - (1-\beta)\theta u, 0\}}$$

Result 1: $x^*(\beta, \theta)$ is
(i) Increasing in β (0 if β is less than some critical value)

(ii) For same β, high types invest less

(iv) This gap decreases as β goes up, 0 at β=1

- For a vendor of type θ facing demand β, **net** expected joint surplus is: $\mathbf{s^*(\beta, \theta) = s(x^*(\beta, \theta)) - \theta}$
- Let $s^*(\beta) = \max \{ s^*(\beta, \underline{\theta}), s^*(\beta, \theta)\}$ (upper envelope)
- Turns out $\mathbf{s^*(\beta)}$ is increasing & convex

Result 2: Given Assumption 1 under the first-best the assembler would give one vendor a certain order of 1 & the other vendor an order of 1 with probability α & 0 with probability 1- α.

Intuition

- When you increase β, shift weight from outside option to surplus within relationship
- So first-order effect of increase in orders (β) on joint surplus $\mathbf{s}^*$ is just the net value of trade inside the relationship: $\mathbf{(V(\theta,x^*) - \gamma(x^*))\ - u(x^*, \theta)}$ which is positive by Assmp. 1 (effect through x is ignored by envelope theorem)
- Second order effect positive as x is increasing in β, so $\mathbf{s^*(\beta)}$ **is convex** (same reason as profit functions of competitive firms ($\pi = pf(x) - x$) are convex in prices
- So indeed will have first & second-preference vendors
- What types will be selected?

Result 3

(i) For $b \leq 1$ both the first & second-preference vendors are going to be low types

(ii) For $b \geq \underline{b}$ where $\underline{b} > 1$ both the first & second-preference vendors are going to be high types.

(iii) For $1 < b \leq \underline{b}$ the first-preference vendor is going to be a high type vendor & the second preference vendor is going to be a high type vendor if α is very low or very high but a low type vendor otherwise.

Intuition

- Low types invest more, so that goes in their favor
- When b is low marginal return from higher quality within the relation is low, so no point having high types at all.
- Opposite when b is high (both 1st & 2nd pref. high types)
- For intermediate values of b can have both
- Since gap between investment is zero when demand is very low or its very high, in this case:
    - First preference vendor is a high type
    - Second preference vendor is a high type if α is low or high but a low type otherwise (high uncertainty)

Immediate corollary:

Result 4: The first-preference vendor will always undertake a higher level of investment than the second-preference vendor, & will have lower unit costs.

Only this does not fit with our findings.

3.2 Extensions

A. Investment & type are substitutes

- Let gross surplus be $\mathbf{S = a + b\theta - 1 + \gamma x - \delta x\theta}$
- Substitutes if $\delta > 0$ complements otherwise

$x(\beta, \theta) = \mathbf{max}\ \{\beta(\gamma - \delta\theta) - (1-\beta)\theta\mathbf{u},\ \mathbf{0}\}$

- Assume $\gamma > \delta$ so high types invest, at least when β high
- Increases the possibility of using some low type vendors

- But if u=0 (so that outside options don't depend on **x** at all) this specification has the implication that the gap between investment of low & high types is increasing in demand
- So if low types are used at all, they will be used as first-preference vendors (also perhaps as second-preference)

B. Specific investment (x) is non-contractible

- Parties bargain over *ex post* surplus, which affects *ex ante* incentives
- *Ex post* surplus if trade takes place: $\mathbf{V(\theta,x)- \gamma(x)}$
- Using Nash bargaining solution
  - Vendor's *ex post* surplus

$$\pi = 1/2 * \{V(\theta,x) - \gamma(x) + u(x,\theta)\}$$

  - Assembler's *ex post* surplus

$$\Pi = 1/2 * \{V(\theta,x) - \gamma(x) - u(x,\theta)\}$$

- Vendor chooses **x** *ex ante* to maximize

$$\{\beta * \pi + (1- \beta) * u(x,\theta)\} \quad - \quad c(x)$$

- Optimal choice:

$$\mathbf{x^{sb}(\beta, \theta) = max\ \{\beta/2*\gamma - (1-\beta/2)*\theta u,\ 0\}}$$

Assumption 2: $\gamma > u$ (Otherwise high types never invest under the second-best even if they have a certain order)

- **x** of both types is less than that under first-best
- Gap between **x** of high types & low types goes up – now increasing **x** is more costly since outside option matters both in keeping flexibility *&* in bargaining & this effect is higher for high types.
- Parameter region for which you might want to have some low type vendors increases
- The first-preference vendor may have higher unit costs compared to the second-preference vendor.

- $\Pi(\beta,\theta)$ **:** Profit *rate* of assembler
- Upper Envelope $\Pi^*(\beta) = \max\{\Pi(\beta, \underline{\theta}), \Pi(\beta, \theta)\}$

- $\beta\Pi^*(\beta)$ increasing & convex in β

Intuition

Allocation depends on properties of *level* of profits when order is β, $\beta * \Pi^*(\beta)$ (as opposed to $\mathbf{s}^*(\beta, \theta)$)

- For low β neither type invests, for intermediate β only low type invests, for high β both types invest.
- A given increase in β elicits a higher increase in **x** from the high types since their investment is more sensitive (negatively) to the weight attached to outside option.
- With CRS, β affects *per unit* profits $\Pi(\beta,\theta)$ via **x** only
- So $\Pi(\beta,\theta)$ is first flat & then increasing linearly (through **x**) in level of orders (β), so weakly convex
- So is $\Pi^*(\beta)$ as it is the upper envelope
- So is *level* of profits $\beta * \Pi^*(\beta)$

Extension: Timely Delivery & Dynamic Incentives

- Some uncertainty regarding whether a vendor would be able to deliver in time.
- Can take a ("good") action to ensure regular delivery - avoid both undersupply or oversupply.
- Can take a ("bad") action to use the asset to supply to the outside market on the side – results in undersupply
- Choose future orders as dynamic incentive device
- Both types need incentives to take the **good** action
- But vendors with high outside options need greater incentives **not** to take the **bad** action
    - Punished *relatively* more for undersupplying
    - Punished *relatively* less for oversupplying

- Measure of asset specificity from survey is "Percentage of total capacity of vendor's plant that would become idle if MTL stopped buying from it"
- One interpretation (Williamson) : aggregate level of quasi rents created by the investment:

$$\frac{S(x,\theta) - \bar{u}(x,\theta)}{S(x,\theta)} = 1 - \frac{\bar{u}(x,\theta)}{S(x,\theta)}$$

where $S(x,\theta) = V(x,\theta) - \gamma(x)$ is gross ex post surplus.

- Increasing in level of reln. specific investment (**x**) & decreasing in θ (if % change in the outside option is higher than % change in surplus within relationship as θ goes up)
- But x depends on θ & varies from case to case

4. Evidence

- **Primary Data:** Vendor-assembler part-level contracts (Price, Quantity, Cost) (Source: MTL records 1989-99)
- **Secondary Data:** Vendor Attributes (28) - Lahore University of Management Sciences (LUMS) survey in 1997

List of Variables

P = Contracted **price** for part for a given vendor in a given **year**;

C = MTL engineer's estimate of **cost** of production of a particular part for a given vendor in a given **year**;

Q_S = **Quantity scheduled** from the vendor during a **quarter**;

Q_R = **Quantity received** from the vendor during a **quarter**;

Total Q_S = **Total quantity** scheduled for a given part from **all** MTL vendors (including those not in our sample) during a quarter

R = Fraction of vendor's quarterly received **quantity** that is **rejected** by MTL quality inspection;

Age = Vendor **age**;

Specificity = Percentage of the total capacity of the vendor's plant that would become idle if MTL stopped buying from it;

Size = Size of the vendor's labor force (in 1995);

Distance = Distance of the vendor (km) from MTL;

City = A dummy variable that equals 1 if the vendor is located in **Karachi** & 0 if in **Lahore**;

- Restrict data: Parts with multiple vendors. Left with 19 vendors, & 39 parts (Table A1)
- Summary statistics (Table 1):
  - Price discrimination: average 25% price differential in same year for given part
  - Quantity variation across vendors: average 3 times qty order
  - Quantity variation over time : CV (vendor-part) = 0.99

- Basic equation:

  - C_{ijt} = contractual feature for part i, vendor j, in year t (e.g. Price, Quantity, Performance Measure)

$$C_{ijt} = \alpha_i + \tau_i + \sum_j \beta_j X_j + error$$

  - X_j = vendor characteristic (e.g specificity, age, size)
  - α_i = product-specific intercept
  - τ_t = year/quarter specific intercept
  - In some cases, lagged value of dep. variable used on RHS

Results

Vendors with higher specificity (tied)

Have lower production costs (Table 3) - one std. deviation increase in tiedness (~40) lowers costs by 6.6%.

(Dependent variable log cost, coefficient -0.0016, so if specificity changes from 0 to 100, $\Delta(\log C)=-0.16$ & so $\Delta C/C = (1- e^{-0.16})*100=15\%$.)

Receive lower prices (Table 4) - one std. deviation increase in tiedness results in a 7.9% lower price level

Receive lower scheduled quantity (Table 5) - one std. deviation increase in tiedness results in 5.5% lower quarterly vendor scheduled quantity

Are treated as second preference:

Greater (3.7% point) elasticity of scheduled quantity with respect to MTL's Total Schedule (Table 8)

Greater (5.4%) CV of scheduled quantity (Table 6)

Lower Quality (various performance measures):

Greater (1 to 1.43%) proportion of rejections (Table 7)

Lower responsiveness to orders: 8.7 % point decrease in elast. to own schedule (Table 9). But maybe they have tougher task.

7.8 % point decrease in elast. to total schedule (Table 10).

Must be less responsive, since face more variable schedule.

Greater tendency to undersupply (24% increase - Table 11) & oversupply (Table 12)

Differential pattern of dynamic incentives (Tables 13-14).

Tied punished less (14% vs. 37%) for under-supplying & more for over-supplying (6.3% decrease in Q_S). Untied is actually rewarded (11.5% increase in Q_S)

Age & size controls (learning by doing, scale economies)

Older Vendors have

Lower cost, lower prices

(weakly) Greater order

Greater rejections, undersupply

Larger Vendors have

(weakly) Lower cost

Lower rejections, (weakly) undersupply

Concerns with Specificity Measure

- Misinterpreted? Unlikely:
  - Correlates with technological measures of specificity & engineering background
  - Uncorrelated with % sales to MTL
    - Highly variable sales
    - Presence of excess capacity
    - As a result could be very tied to MTL, yet using the flexible part of your capacity to make most sales in a bad year for MTL
    - On the other hand, could be quite flexible, but sell a lot to MTL because get good price, can switch anytime you want

- Subjective? Bi-modal distribution & results same with 0-1 measure

Discussion

- Specificity picks up vendor quality, so endo. But given data we can't separate out effect of investment **x** from type of vendor θ (fixed effects or instruments no help)
- Can use (potentially biased) estimates to see if unobserved vendor heterogeneity matters in interpreting effects of specificity on various outcomes using theory
- Results are compatible with case where **b** is intermediate & uncertainty is high (α not too high or low)
    - Tied vendors have lower quality (despite tying)
    - Tied vendors have lower costs & price
    - Tied vendors treated as marginal vendors (low, unstable order)
- If dealt with only high or low types then first preference vendor should have higher **x** & the one with higher x should perform better – not true
- If first-preference vendor is low type, then should definitely have higher specificity than second-preference

Alternative Explanations

- Sales reliance on MTL? (case where u=0 & so u=θ)
  - Sales & specificity measure uncorrelated.
  - Why have both types? Scarcity of good types is unlikely
    - Large vendor pool
    - High types supply to others, have excess capacity
- Specificity is, theoretically, vendor-part specific & not just vendor specific. Large human capital element
- Ex Ante Differences in Quality or Ex Post Differences in Behavior?
  - Greater specificity worsens performance?
  - Unlikely – would expect the opposite
  - Not an environment where learning & innovation is important
  - Even if it did, why would identical vendors choose to get tied to MTL?
    - Risk sharing cannot explain it
    - No evidence of other forms of compensation

Conclusion

- Selection Important when studying contracting
- Lessons about Industrial organization in LDCs
  - Uncertainty & problem of excess capacity
  - Constrained efficient response: allow low quality vendors to operate as "capacity buffers"
    - Low opportunity cost of labor
    - High profit margin for MTL in protected market
  - Important to account for these features when measuring productivity
- Increase in competition that squeezes MTL's profit margin (a-1 goes down) will tend to make low types unattractive
  - Only deal with high types
  - Not bother supplying in the high state

TABLE II
LABOR REGULATION AND INDUSTRIAL DISPUTES IN INDIA: 1958–1992

	(1)	(2)	(3)	(4)
	Workdays lost to strikes per worker	Workdays lost to strikes per worker	Workdays lost to lockouts per worker	Workdays lost to lockouts per worker
Method	OLS	OLS	OLS	OLS
Labor regulation	2.564**	1.732*	2.108**	0.965***
$[t - 1]$	(2.55)	(1.87)	(2.32)	(3.57)
State effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
State time trends	NO	YES	NO	YES
Adjusted R^2	0.08	0.07	0.14	0.15
Observations	547	547	514	514

Absolute t-statistics calculated using robust standard errors clustered at the state level are reported in parentheses, * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent. Data on workdays lost to strikes and lockouts are expressed on an annual basis, and we divide this by number of workers employed to get a per-worker measure. State amendments to the Industrial Disputes Act are coded 1 = pro-worker, 0 = neutral, −1 = pro-employer and then cumulated over the period to generate the labor regulation measure. The data are for the sixteen main states for the period 1958–1992. Haryana split from the Punjab in 1965, and, after this date, we include Haryana as a separate observation. We therefore have a total of 552 possible observations with deviations accounted for by missing data. See Appendix 1 for details on the construction and sources of the variables.

Columns (2) and (4) show this finding to be robust to including state-specific time trends. Thus, regulating in a pro-worker direction appears to be associated with greater disruption of production. This validates our measure as a representation of the industrial relations climate.

II.B. Theoretical Considerations

The defining difference between registered and unregistered firms is scale, with labor regulations affecting only registered firms. It is reasonable to suppose that all firms operate in a common set of factor markets whose prices they treat as parametric. For simplicity, suppose that firms all produce a common manufactured good. There are then two main routes via which labor regulation affects economic performance—a *relative price effect* and an *expropriation effect.* While intellectually distinct, they have similar implications for what we expect to find in the data.

The relative price effect is relevant if the effect of labor regulation is to raise the (fixed or marginal) cost of employing laborers. Labor regulation will typically create adjustment costs in hiring and firing labor and in making adjustments in the

TABLE III
LABOR REGULATION AND OUTPUT IN INDIA: 1958–1992

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Log state output per capita	Log state agricultural output per capita	Log state nonagricultural output per capita	Log state construction output per capita	Log total manufacturing output per capita	Log registered manufacturing output per capita	Log unregistered manufacturing output per capita
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Labor regulation $[t-1]$	−0.002	0.019*	−0.034*	−0.019	−0.073**	−0.186***	0.086**
	(0.14)	(1.81)	(1.69)	(0.29)	(2.05)	(2.90)	(2.46)
State effects	YES	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.93	0.84	0.95	0.76	0.93	0.93	0.75
Observations	509	509	509	509	509	508	509

Absolute t-statistics calculated using robust standard errors clustered at the state level are reported in parentheses, * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent. Total, nonagricultural, agricultural, total manufacturing, registered manufacturing, and unregistered manufacturing output figures are all components of state domestic product and are expressed in log real per capita terms. State amendments to the Industrial Disputes Act are coded 1 = pro-worker, 0 = neutral, −1 = pro-employer and then cumulated over the period to generate the labor regulation measure. The data are for the sixteen main states for the period 1958–1992. Haryana split from the Punjab in 1965, and, after this date, we include Haryana as a separate observation. We therefore have a total of 552 possible observations with deviations accounted for by missing data. See Appendix 1 for details on the construction and sources of the variables.

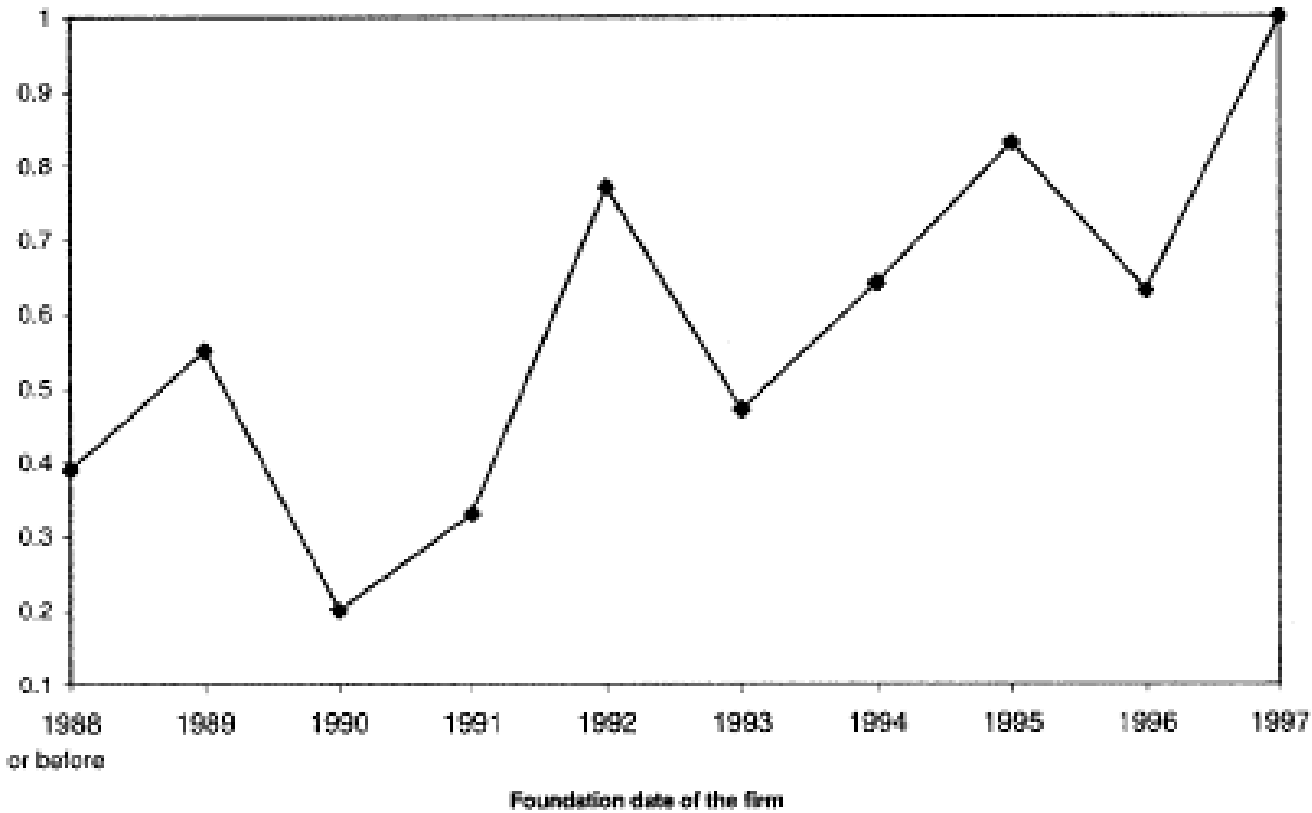


FIGURE I
Proportion of Fixed Cost Contracts

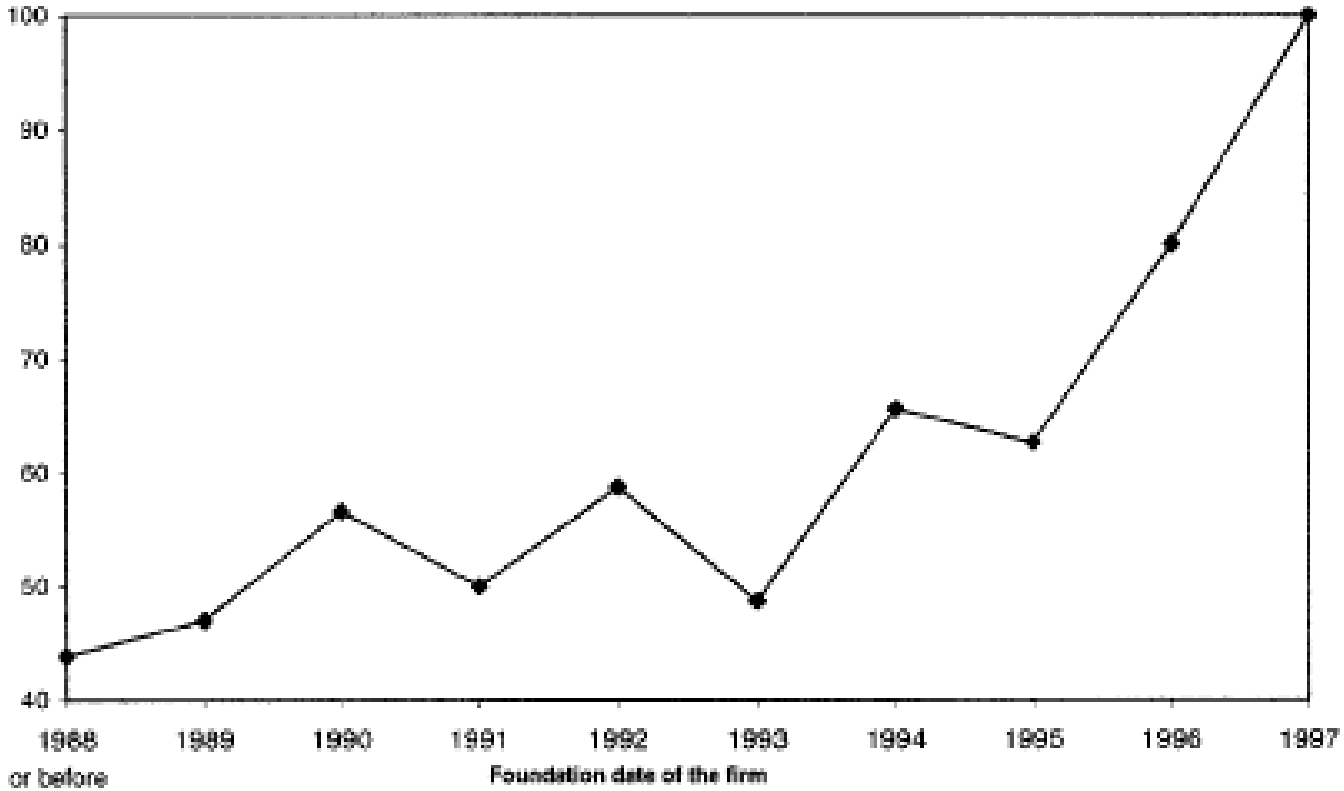


FIGURE II
Share of Overrun Paid for by the Firm

TABLE III
REGRESSION RESULTS: CHOICE OF CONTRACTS AND SHARE OF OVERRUN PAID BY THE FIRM

	Choice of contract		Share of overrun paid by the firm					
			Unconditional				Conditional	
	Ordered probit		Random effect		Fixed effect		Random effect	Fixed effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reputation								
Young firm	−0.69*		15*				9.0	
	(0.25)		(8.5)				(8.6)	
Repeated contract	0.22		−17*		−20		−15*	−19
	(0.24)		(8.8)		(16)		(8.7)	(17)
ISO-certified firm	−0.27		17				16	
	(0.32)		(13)				(13)	
Internal project		0.87*		−25*		−64*		
		(0.31)		(11)		(26)		
Contract								
Fixed-cost contract							13	12
							(9.4)	(25)
Time and material contract							−12	15
							(13)	(34)
Firm and client characteristics								
Number of employees (/100)	0.44	−0.44	−4.1	−2.4			−4.8	
	(0.98)	(1.1)	(7.7)	(5.0)			(4.5)	
Client is big	0.15	−0.18	−17	−13	−16	−40	16	−16
	(0.22)	(0.30)	(8.5)	(10)	(16)	(32)	(8.3)	(16)
Client is Indian	−0.43*	−0.76	13	23	−46*	14	9.3	−45*
	(0.27)	(0.63)	(9.5)	(18)	(20)	(41)	(9.5)	(21)
Project characteristics								
Estimated project size (man-months/10)	0.01	0.00	−0.12	0.35	−2.4	2.1	−0.13	−2.1
	(0.017)	(0.011)	(7.7)	(.38)	(1.9)	(2.6)	(0.76)	(2.0)
Area is familiar	0.08	0.09	−9.0	−4.0	18.9	−1.5	−6.3	16
	(0.25)	(.027)	(9.4)	(12)	(21)	(28)	(9.2)	(22)
Platform is familiar	0.60	0.20	26	1.9	48	61	29	49
	(0.48)	(0.59)	(20)	(12)	(35)	(74)	(19)	(36)
Y2K, data manipulation, etc.	−0.13	0.15	19	−4.8	−47		15	−41
	(0.32)	(0.35)	(17)	(25)	(36)		(16)	(39)

Standard errors (corrected for clustering at the firm level in columns (1) and (2) are in parentheses.
An asterisk indicates that the coefficient is significant at the 90 percent level of confidence.
All regressions include the following additional variables: number of employees squared, project size squared, and an indicator for whether tools are familiar to the firm. Sample in columns (1), (3), (5), (7), and (8) include all external projects (167 projects in 92 firms). Sample in columns (2), (4), and (6) include all projects of firms that do some internal work (88 projects in 58 firms).

TABLE IV

REGRESSION RESULTS: OVERRUNS AND PROJECT CHARACTERISTICS

	Total overrun		Overrun due to the firm					
	Unconditional	Conditional	Unconditional	Conditional	Delay	Project size	Y2K	Subjective complexity
	Random effect	Random effect	Random effect	Random effect	Probit	Median regression	Probit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reputation								
Young firm	−0.48	−3.8	2.5	1.5	−0.28	−6.4	0.48*	−0.42*
	(5.0)	(5.0)	(3.4)	(3.5)	(0.22)	(5.4)	(0.29)	(0.21)
Repeated contract	1.8	1.5	−0.92	−1.2	−0.2	−16.3*	0.34	−0.07
	(4.9)	(4.8)	(3.5)	(3.5)	(0.24)	(5.4)	(0.30)	(0.20)
ISO-certified firm	15	16	5.4	6.1	0.28	18*	−0.52	0.08
	(7.9)	(7.7)	(5.4)	(5.5)	(0.37)	(8.5)	(0.40)	(0.21)
Contract								
Fixed-cost contract		14*		5.5				
		(5.4)		(3.9)				
Time and material contract		5.5		5.6				
		(7.5)		(5.4)				
Firm and client characteristics								
Number of employees (/100)	−0.77*	−0.38	0.32	0.38	0.08	7.2*	0.23*	0.11*
	(0.24)	(0.24)	(1.7)	(1.7)	(0.13)	(2.4)	(0.11)	(0.066)
Client is big	0.88	0.43	1.8	1.3	−0.34	7.4	−0.05	0.11
	(4.8)	(4.8)	(3.4)	(3.4)	(0.23)	(5.3)	(0.24)	(0.17)
Client is Indian	4.1	2.8	−0.55	−0.78	0.07	−12*	−0.34	0.03
	(5.6)	(5.6)	(4.0)	(4.0)	(0.25)	(6.4)	(0.33)	(0.18)
Project characteristics								
Estimated project size (man-months)	0.11*	0.11*	0.04	0.04	0.01			
	(0.040)	(0.040)	(0.03)	(0.03)	(0.22)			
Area is familiar	−5.6	−5.9	−1.5	−1.6	0.08			
	(5.1)	(5.1)	(3.7)	(3.7)	(0.25)			
Platform is familiar	−20*	−18*	−12*	−12*	0.21			
	(10)	(10)	(7.4)	(7.5)	(0.58)			
Y2K, data manipulation, etc.	−13*	−13*	−9.41*	−8.8*	0.20			
	(7.2)	(7.1)	(5.1)	(5.1)	(0.32)			

Standard errors (corrected for clustering at the firm level in columns (5), (7), and (8)) are in parentheses.
An asterisk indicates that the coefficient is significant at the 90 percent level of confidence.
All regressions include the following additional variables: number of employees squared, project size squared, and indicator for whether tools are familiar to the firm.
Sample includes all external projects (167 projects in 92 firms).

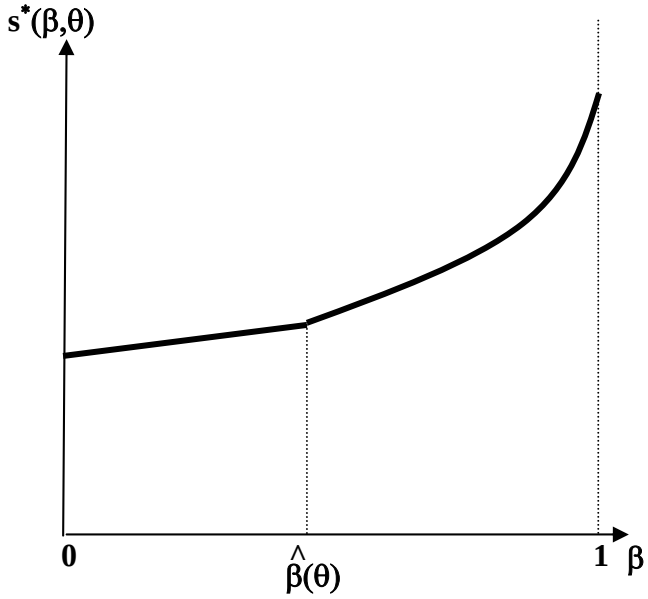


Figure 2

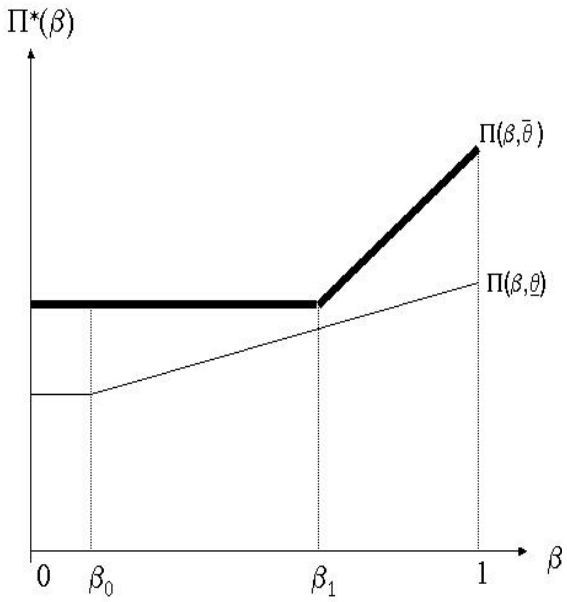


Figure 3 (a)

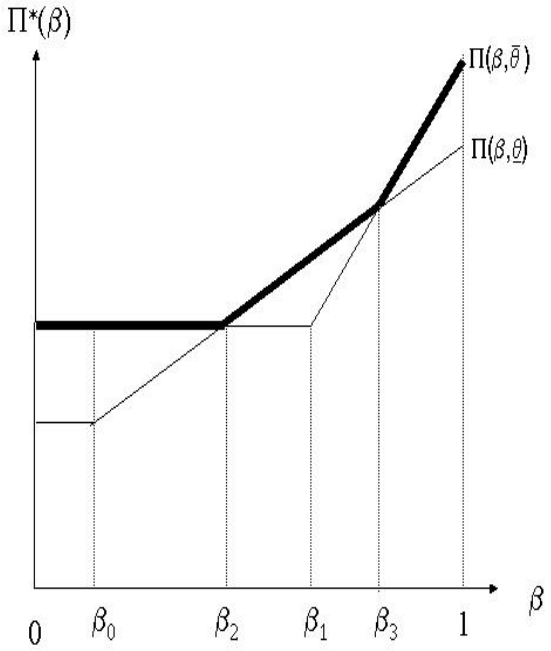


Figure 3 (b)

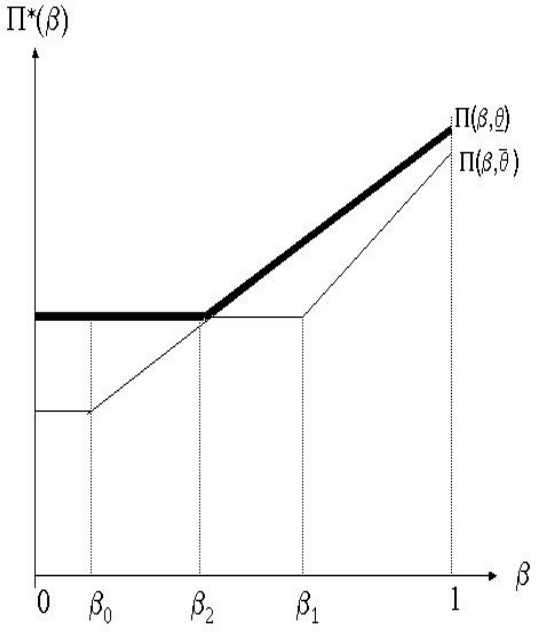


Figure 3 (c)