Corruption and Product Market Competition

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Fighting corruption – important policy issue

One potential approach: encouraging competition in product markets

Theory shows that the relationship between corruption and the degree of product markets competition is complicated and depends on various factors such as the nature of corruption, technologies employed by the firms, preferences of corrupt officials, probability of punishment, and information that the officials possess about firms

Existing theory

Bliss and Di Tella (1997) assume that each official deals with only one firm and the officials do not know the precise amount of rent enjoyed by the firm they oversee, but they know the distribution of these rents. Each official deals with one firm and has the power to exact the money from the firm. The officials do not take into account the effect of their bribe demands on the ability of other officials to extract bribes. The official's problem then is to demand the bribe that maximizes the expected value of bribe revenue while the firm agrees to pay the bribe as long as it is smaller than the firm's rent. Otherwise, the firm exits the market.

$F(C)$ - cumulative distribution of overhead costs that measures the probability that a particular firm will have overhead costs no greater than C; $F(0) = 0, F(\infty) = 1$, and $F(.)$ is an increasing function of C.

C_0 – equilibrium threshold value of costs: only firms with $C < C_0$ operate;

$A = F(C_0)$ – proportion of firms operating in equilibrium;

G – bribe payment demanded by the corrupt agent;

P – operating profit each firm is making (before overhead costs and bribes).

Axiom. $\frac{\partial P}{\partial A} < 0$.

The firm would pay G if its $C \leq (P - G)$. Therefore, the corrupt official faces the following problem:

$$\max_G \{G \times F(P - G)\}$$

Consider interior equilibria

FOC: $F(P-G) - G \times F_1(P-G) = 0$

SOC: $S = -2F_1(P-G) + G \times F_{11}(P-G) < 0$

Theorem 1. When profitability is varied, the rate of change of graft with respect to profit is less than one, $\frac{\partial G}{\partial P} < 1$.

(Proof is by total differentiation of FOC and using SOC.)

THEOREM 2. When G is a unique function of P (i.e., no multiple equilibria), there exists a unique equilibrium density of (the overhead costs of) the firms that are in business.

The degree of competition is based on three “deep competition” parameters:

(1) the degree of substitutability of the firms’ products (lower profits for a given A);

(2) the degree of similarity of the firms’ production functions; and

(3) the amount of fixed (overhead) costs in the industry.

Under (1) and (2) the relationship between competition and corruption is ambiguous.

Under (3) greater competition always increases corruption. I consider only (3).

Competition Case 3: *Higher Overhead Costs*
(Shifting the Support)

In deriving this result we make two assumptions:

(1) The support of F is $[C_{min} + \phi, C_{max} + \phi]$ so that ϕ acts as a support shifter.

(2) The function F is uniform.

Proposition 3. A decrease in competition characterized by higher fixed costs always decreases graft per firm and the proportion of firms operating.

Proof. Consider a system $A = F(C_0) = F(P - G)$ and FOC $[F(P - G) - GF_1(P - G) = 0]$

where $F(C) = \frac{C-(C_{min}+\phi)}{C_{max}-C_{min}}, C \in [C_{min} + \phi, C_{max} + \phi]$. Differentiating implicitly with respect to ϕ we obtain:

$$\frac{dA}{d\phi} = \frac{1}{-2(C_{max} - C_{min}) + \frac{\partial P}{\partial A}}$$

and $$\frac{dG}{d\phi} = \frac{(C_{max}-C_{min})}{-2(C_{max}-C_{min})+\frac{\partial P}{\partial A}}$$

both of which are always negative. Intuitively, $\frac{dG}{d\phi} < 0$ because rent $(P - \phi)$ declines in ϕ: $\frac{dP}{d\phi} - 1 = \frac{dP}{dA}\frac{dA}{d\phi} - 1 = \frac{\frac{\partial P}{\partial A} + 2(C_{max} - C_{min}) - \frac{\partial P}{\partial A}}{-2(C_{max} - C_{min}) + \frac{\partial P}{\partial A}} < 0$; and lower P implies lower G in this setup.

Ades and Di Tella (1999) also assume that each official deals with only one firm, but here the official knows precisely the firm's amount of profit which is random (0 or π) and is not observed by the state. The official may collude with the firm to hide the true amount of profit in exchange for a bribe equal to the firm's profit. If the bribe is detected by the state, however, the official loses his wage and incurs other idiosyncratic costs. The state's problem is to set the officials' (efficiency) wages in such a way as to reveal the greatest amount of profit net of the officials' wages. The officials have different costs of punishment for taking a bribe, so that there are both honest and corrupt officials in equilibrium. The degree of competition is measured by the exogenous number of firms in the market and the extent of corruption is defined as the proportion of corrupt officials. As competition increases, the each firm's profit declines and the same wage represents a bigger deterrent to corruption. However, lower firm profit (and hence lower bribe) also means lower efficiency wage, because it becomes less attractive for the state to induce honesty (taxation is less attractive).

Result: corruption decreases in the number of firms unless increased competition leads the state to decrease the officials' wages too much.

Both models outlined above assume that the bribes represent pure extortion and are obtained from the firms' pre-existing rents. Depending on what determines the degree of competition, greater competition may reduce rents available for payment of bribes and in that case competition tends to reduce corruption.

However, bribes are often paid ***in return for some service*** even if this service consists in letting the firm bypass some regulation or informal "red tape" that exist to facilitate bribe-taking. Corrupt officials are not always free to extract firms' rents, but can charge bribes only up to the value of the service they are providing to the firm.

Shleifer and Vishny (1993): extortion is more difficult to hide and easier to fight than cost-reducing corruption such as when an importer pays a bribe instead of the official customs duty or a firm pays a bribe to avoid complying with costly regulations "[c]ompetition between buyers of government services assures the spread of cost-reducing corruption."

Simple model of cost-reducing corruption

N Cournot competitors producing identical good at $MC = c = const$ and with common fixed cost, f, and facing an inverse demand curve $p = a - Q$, where $Q = \sum_{i=1}^{N} q_i$ and q_i is output of firm i;

f and c determine N via a zero profit condition

Assume that all firms have the same opportunities for cost reduction via a bribe and that the corrupt official obtains 100% of the cost saving.

Let Δf and Δc be firm's fixed cost and marginal cost reduction, respectively.

Then the total bribe and bribe tax in each case would be, respectively:

	Fixed costs reduction	Marginal cost reduction
Total bribe:	$\Delta f N$	$\Delta c N q_i = \Delta c N \frac{a-c}{N+1}$
Bribe tax:	$\frac{\Delta f N}{p q_i} = \frac{\Delta f (N+1)^2}{(a-c)(a+Nc)}$	$\frac{\Delta c q_i}{p q_i} = \frac{\Delta c}{p} = \frac{\Delta c (N+1)}{a+Nc}$

Obviously, both total bribe and bribe tax increase in N (and, therefore, decrease in f)

Conclusion: when corruption is cost-reducing, the bribe tax is positively related to the degree of competition; when corruption is extortionary, the bribe tax may or may not be positively related to the degree of competition

→ the outcome of an empirical test of the relationship between competition and corruption depends on whether corruption measures used in the test reflect largely cost-reducing or extortion variety of corruption; in addition, the outcome depends on what determines the degree of competition.

There has been little empirical analysis of this issue:

Ades and Di Tella (1999) and Emerson (2006) both use cross-country data to show that countries characterized by greater degree of product market competition tend to have less corruption

Problems with cross-country approach:

- small number of observations

- possibility of omitted variable bias

- difficult to account for reverse causality

- measurement difficulties (e.g, market competition is measured as the share of imports in GDP, the importance of fuels and minerals in exports, the distance to world's major exporters, and indicators of economy's "competitiveness")

My main goal: to provide an empirical investigation of the relationship between product market competition and corruption that alleviates the most important flaws of the existing work by using a firm-level survey data that allow for better measures of competition and corruption and better controls and instruments than cross-country data.

Main result: firms in more competitive environments tend to pay a greater percentage of their sales in bribes

The Data and Estimation Approach

Firm-level Productivity and the Investment Climate Private Enterprise Survey (PICS), excluding high income countries. After dropping observations that do not contain information on the variables relevant to our analysis, we use 4,700 - 15,500 observations on manufacturing firms (depending on specification) in benchmark regressions.

Regressions that use firm-level capital-labor ratio have fewer observations.

Dependent variable: ***bribe tax*** = fraction of annual sales paid in bribes reported by firm i in country c and in year t; bribe tax reflects "informal payments to public officials to 'get things done' with regard to customs, taxes, licenses, regulations, services etc." ➔ this question can be interpreted as being mostly about cost-reducing corruption rather than extortion of rents. In fact, what we test is essentially whether the answers to this question reflect cost-reducing corruption.

Because many firms report zero values for bribe tax, it might be advisable to use **Tobit**. We estimate the following basic equation:

$$BRIBE\_TAX_{ict} = \gamma_0 + \gamma_1 COMPETITION_{ict} + \gamma_2 X_{ict} + \gamma_3 Z_{ct} + \varepsilon_{ict},$$

where $COMPETITION_{ict}$ is a measure of competition, X_{ict} is a vector of other firm characteristics, and Z_{ct} is a vector of country and year fixed effects.

Measures of competition

(1) ***Number of competitors:*** Logarithm of 1+ number of competitors the firm has.

(2) ***Customer reaction*****:** customer reaction to a 10% price increase. It has four discrete values from 1 to 4 with higher values reflecting greater competition faced by the firm;

(3) ***Market shares (local and national)*****:** Logarithm of 1+ national (local) market share of the firm (in %);

(4) ***Markup*****:** price markup over costs $\frac{pq-total\ cost}{pq}$; All markups < -0.1 are replaced with -0.1;

(5) ***Logarithm of Herfindahl-Hirschman Index (HHI)***$= \ln\{\sum\left(\frac{q_i}{Q}\right)^2\}$ based on the survey;

Measures (1), (2), and (4) are more likely to reflect the true competitive environment of the firm, because measure (3) refers to the firm's share of national or local market, and therefore, may be misleading with respect to the degree of competition in the firm's other markets (foreign or national). Measure (5) depends on the firm's industry, and the industry classification in the survey is very broad, making the relationship between the HHI and the competitive environment of a given firm rather tenuous.

Instruments

Competition and corruption are likely to be endogenous because corrupt officials may attempt to limit competition among firms they oversee.

We instrument competition by two different sets of instruments: (1) the **US industry's capital-labor ratio** and (logarithm of) **HHI** or

(2) the **firm's capital-labor ratio and capacity utilization**.

Capital-labor ratio is a proxy for the firm's fixed costs. Other things equal, the higher the capital-labor ratio the more difficult it is to enter the industry. HHI represents the degree of concentration in the corresponding US industry and presumably reflects some technological aspects of the industry that determine the degree of competition in it.

Instruments in benchmark regressions: 2002 K/L and HHI for the corresponding 3-digit US industries.

Advantages: clearly exogenous to the corruption environment in other countries.

Disadvantages: may not necessarily reflect the technologies in more narrow industries of the firms in the survey and the US technologies might not be the same as those that would have been used in other countries even if corruption were not a factor.

Alternative instruments: firms' capital-labor ratios and capacity utilization.

Advantages: better reflect fixed costs in its narrowly defined industry.

Disadvantages: might be endogenous to bribes and the endogeneity could go in either direction. Because of this potential endogeneity with corruption, we use firm-level instruments only as a robustness check.

Controls: firm location characteristics (population of the city in which the firm is located and a dummy variable for capital city) as well as firm's age and country and year fixed effects.

Other controls can be used such as the percentage of government ownership (*State Owned*), the percentage of foreign ownership (*Foreign Owned*), firm size measured by a logarithm of one plus employment, the share of sales the firm exports directly, but these variables could be endogenous with corruption. Therefore, I am not going to present those results, although they are similar to the results I am going to present.

Results

Tobit regressions

Dependent variable: *Logarithm of one plus bribe tax*

Variable name	Coefficient	Pseudo R^2	Observations	Left-censored observations
Customer reaction (p-value)	.049** (.022)	.042	7,603	4,519
HHI (p-value)	-.035 (.109)	.084	15,002	9,087
Market share – national (p-value)	.035 (.117)	.100	5,823	3,309
Market share – local (p-value)	.058 (.247)	.118	2,055	1,373
Markup (p-value)	-.170 (.136)	.086	6,589	4,302
Number of competitors (p-value)	.030* (.054)	.109	5,122	2,522

Notes: *, **, *** indicate significance levels of 10%, 5%, and 1%, respectively; highlighted estimates have the sign that contradicts the expectation, but the estimates are not statistically significant

Instrumental variables estimation

Potential simultaneity bias between corruption and the intensity of product market competition represents a problem in estimating the relationship between them. However, this simultaneity is likely to bias the estimates of the coefficients of the number of firm's competitors and of customer reaction in Tobit estimates of equation (1) downwards and the coefficients of market shares, markup, and HHI upwards → our expectation is that the IV estimates of equation (1) would alleviate these biases and change the point estimates of the relevant coefficients in the direction of a positive relationship between the degree of product market competition and corruption.

In all specifications, the IV Tobit point estimates of the coefficients change in the predicted fashion relative to simple Tobit estimates and the signs of all IV Tobit estimates are consistent with a positive relationship between competition and corruption. However, the IV coefficients are less statistically significant than non-IV Tobit estimates. The drop in statistical significance occurs presumably because the broad industry-level characteristics may not sufficiently closely reflect the competitive environment facing a particular firm even in the absence of corruption.

When we use firm-level instruments, the coefficients of our measures of competition are all consistent with a positive relationship between competition and corruption and are highly statistically significant in all but one specification. The lone exception is customer reaction specification that is particularly difficult to instrument because of the discrete nature of this measure of competition.

Table 5. Tobit IV regressions (excluded instruments: US capital-labor ratio and US HHI)

	Panel A (First stage regressions)					
	(1)	(2)	(3)	(4)	(5)	(6)
1st stage dep. var. →	HHI	Market share (national)	Market share (local)	Markup	No. of competitors	Customer reaction
Capital-labor ratio (US)	.058 (.794)	.377*** (.005)	.004 (.976)	.027** (.016)	-.267* (.059)	-.097* (.078)
HHI (US)	.170* (.075)	.062 (.477)	.251*** (.003)	-.003 (.712)	-.168** (.043)	.036 (.306)
Panel B (Second stage regressions; dependent variable: Bribe Tax)						
HHI	-.108 (.467)	-	-	-	-	-
Market share (national)	-	-.145 (.541)	-	-	-	-
Market share (local)	-	-	-.298 (.368)	-	-	-
Markup	-	-	-	-5.89 (.499)	-	-
Number of competitors	-	-	-	-	.327** (.050)	-
Customer reaction	-	-	-	-	-	1.59 (.459)

Notes: #, *, **, *** indicate significance levels of 15%, 10%, 5%, and 1%, respectively; p-values are in parentheses.

Numerical importance of competition measures: substantial but not overwhelming

Bribe tax elasticity with respect to the number of competitors is about 0.4;

Bribe tax elasticity with respect to HHI is about 0.1;

Non-instrumental Tobit estimates are smaller in terms of their impact on bribe tax.

Table 7. Tobit IV regressions (excluded instruments: firm-level capital-labor ratios and capacity utilization)

	Panel A (First stage regressions)				
	(1)	(2)	(3)	(4)	(5)
1st stage dependent variable →	Customer reaction	Market share (local)	Market share (national)	Markup	No. of competitors
Capital-labor ratio (firm)	-.061*** (.021)	.123*** (.031)	.108*** (.018)	.011*** (.003)	-.157*** (.019)
Capacity utilization	-.004*** (.001)	-.006*** (.002)	.004*** (.001)	.001*** (.000)	-.002** (.001)
	Panel B (Second stage regressions; dependent variable: Bribe Tax)				
Customer reaction	.700 (.556)	-	-	-	-
Market share (local)	-	-.808* (.444)			
Market share (national)	-	-	-.619*** (.193)	-	-
Markup	-	-	-	-4.73** (2.10)	-
Number of competitors	-	-	-	-	.426*** (.134)
p-value for Wald test of exogeneity	.201	.076	.000	.036	.004
Observations	1,629	1,571	3,593	3,356	3,899
Left-censor. observations	3,961	1,096	1,986	2,320	1,886

Notes: #, *, **, *** indicate significance levels of 15%, 10%, 5%, and 1%, respectively ; Standard errors are in parentheses

Conclusion

While competition might reduce surplus-shifting corruption (extortion of rents), **cost-reducing corruption is likely to be promoted by competition;**

In contrast to existing literature, our estimates suggest that more competition is (weakly) associated with greater corruption, implying that the firms in the World Bank's enterprise survey face mostly cost-reducing corruption;

This result continues to hold, albeit weakly, when we adjust for the potential endogeneity between corruption and competition.

Advantages of our approach: the use of firm-level instead of cross-country data, letting us

- rely on information specific to competitive and institutional environment of particular firms;

- use apparently valid (or at least better) instruments;

- use a large number of observations and country and year fixed effects.

Our findings do not necessarily contradict the existing literature, but rather call for a more nuanced view of corruption, emphasizing the need to distinguish between surplus-shifting and cost-reducing corruption.

Our results are not an argument against promoting product market competition among firms. The effect of competition even on cost-reducing corruption depends significantly on the factors that restrict competition. Our findings do imply that ***other things being equal*** competition by itself does not tend to reduce corruption and may even promote it.