



# Insights from a multi-level analysis of bribe prevalence in developing countries

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# Highlights

- **Objective:** This paper sets a multi-level framework to review key determinants of corruption in developing countries: the economic and human development processes, state interventions, trade openness and democracy.
- **Motivations:**
  - ✓ **multi-level analytical framework:** Because of shared norms of ethics, trust, and coordination prevailing in a given social group, corrupt individual decisions may be related to each other.
  - ✓ **multi-level empirical framework:** this interdependence of corruption decisions can be addressed through multi-level modelling of micro corruption data.
- **Method and message:**
  - ✓ Extensive literature review to i) motivate the use of a multi-level framework and to ii) analyze empirical results.
  - ✓ Exploiting a sample of 34,358 bribe reports of firms from 71 developing and transition countries, a multi-level modelling of bribery data refines the diagnosis on corruption determinants.

# MOTIVATIONS

# Motivations

- The literature on **the demand side of corrupt transactions** depicts corruption as :
  - ✓ the result of a **tension between public agents' own interest and the general interest** (Banfield, 1975).
  - ✓ an **individually-driven phenomenon**, resulting from a cost-benefit analysis made by public agents.
- The literature on **the supply side of corrupt transactions** depicts corruption as:
  - ✓ the result of a **tension between an individual or organization's pecuniary objectives and the legal and social norms of ethics and integrity** prevailing in a society (Banfield, 1975).
  - ✓ an individually-driven and **context-driven** phenomenon.

# Motivations

- Socio-economic studies stress how **social capital and its manifestations** – social norms of ethics and trust – ensure the **reciprocity/predictability in corrupt exchanges** (Lambsdorff and Frank, 2011; Graeff, 2005).
- **Reciprocity and corruption prevalence:**
  - ✓ Reciprocity in corrupt deals is ensured through norms of ethics or **corruption norms** = “expectation that one can usually offer or accept a corrupt deal in a certain situation” (Graeff, 2005).
  - ✓ When social norms of corruption do not fully operate, reciprocity in corrupt deals is ensured through **interpersonal trust**, favoured by network membership (kinship, ethnic group, gender, social/religious status).
  - ✓ So that corruption may be persistent in societies/groups with broad civic and ethical norms.

# Motivations

- Following Max Weber's theory of modernization, Andvig (2006) depicts corrupt societies as dynamic hybrid systems where emerging and ancient coordination modes confront each other.
- In his framework, **systemic corruption** results from the overlap between older – illegal but legitimate – and newer – legal but illegitimate – norms of coordination:
  - ✓ **patrimonial corruption** stems from the persistence of family/friendship transactions while political/bureaucratic or commercial transactions should be the norm;
  - ✓ **commercial corruption** stems from the persistence of family/friendship transactions or political/bureaucratic transactions while market transactions should be the norm;
  - ✓ and **state capture** arises from the illegitimate intrusion of market-based or kinship/friendship transactions in the area of political transactions.

**Context matters:** corrupt individual decisions are correlated with each other.

↪ Multi-level models relax this H of independence of observations (Hox, 2010).

# ESTIMATION FRAMEWORK

## Empirical specification

- In a **single-level estimation framework**, pooled estimations of the following baseline econometric model would be conducted:

$$Bribe_{i,k} = \alpha + \beta \cdot X_i + \gamma \cdot Y_{i,k} + d_j + \varepsilon_{i,k} \quad (1)$$

$X_i$ , country-level corruption determinants.  $Y_{i,k}$ , firm  $k$  characteristics from country  $i$ .  $d_j$ , dummy sector  $j$ , and  $\varepsilon$  a i.i.d error term.

→ Pb: in this framework, it is assumed that **observations are independent**.

- The 3-level framework models **intra-class correlation** at the sector  $j$  level, nested in country  $i$  level, by including:
  - ✓ random intercepts:  $\alpha = \alpha_3 + \alpha_{2,i} + \alpha_{1,i,j}$
  - ✓ random slopes:  $\beta = \beta_3 + \beta_{2,i} + \beta_{1,i,j}$
- Estimation of the following MLP model (ML estimator):

$$Bribe_{i,j,k} = [\alpha_0 + \alpha_{1,i} + \alpha_{2,i,j}] + [\beta_1 + \beta_{2,i} + \beta_{3,i,j}] \cdot X_i + \gamma \cdot Y_{i,j,k} + d_j + \varepsilon_{i,j,k} \quad (2)$$



## The data

- **Corruption measurement** reflecting firms' experience of bribery in conducting business drawn from the WBES.
- **Dependent variable 1: Bribe payment (BP) variable.**
  - ✓ reported informal payments, expressed as a % of annual sales.
  - ✓ Bi-dimensional variable: an increase in bribe payment can be induced by an increase in the **incidence** and/or an increase in the **size** of bribes.
- **Dependent variable 2: Bribe incidence (BI) variable.**
  - ✓ BI=1 if the firm has reported an informal payment, BI=0 if it has reported no informal payment.
  - ✓ Unidimensional variable: reflects the frequency of corrupt transactions
- **Firm controls:** log of total sales, % of direct and indirect exports in total sales, firm size, % of public ownership, % of working capital funded by internal and external funds, sector of activity (using sector dummies).

## Addressing endogeneity

There are various reasons to expect that multi-level estimates of **country-level determinants** of corruption reflect their causal effects on **firm-level bribery**:

**Argument 1:** a transaction undertaken by a single firm should have no macro-level effects (Farla, 2014).

*Limit: if bribes are contagious (Andvig and Moene, 1990), one bribe could have aggregate effects.*

**Argument 2:** intra-class correlation that could induce reverse causality and measurement errors is modelled in multi-level estimations.

**Multi-level estimates should not suffer from reverse causality bias and measurement errors**

# EMPIRICAL ANALYSIS

## Scope of analysis

Exploiting a baseline sample of **34,358 bribe reports** of firms from **71 developing and transition countries**, I use a 3-level estimation framework to re-examine five controversies on the determinants of corruption:

- ✓ The economic development process
- ✓ The human development process
- ✓ State interventions
- ✓ Trade openness
- ✓ Democracy

## Economic development and corruption

Effect of the **GDP per capita** on bribery.

Variable source: WDI

### Hypothesis testing:

*H1: Corruption will be lower in more economically developed countries, because populations are wealthier, more educated, and institutions are better.  
(Treisman, 2000)*

*H1': Corruption will be higher in more economically developed countries, because modernization creates new grounds for corrupt transactions.*

(Andvig, 2006)

## Human development and corruption

Effect of demography – **fertility rates** – and human capital – **primary enrolment ratio** – on bribery.

Variables source: UNESCO

### Hypothesis testing:

H2: corruption will be higher in countries with large population and low-human capital, and will therefore increase with fertility rates.

(Becker, 1960; Banerjee, 1997; Fisman and Gatti, 2002)

H3: Corruption will be lower in countries with higher educational attainment, because a more educated population allows a better monitoring of public decision-making.

(Glaeser et al., 2004; Svensson, 2005)

*H3': Corruption will be higher in countries with higher educational attainment, because a more educated population leads to the creation of new rents in the economy.*

(Eicher et al, 2009)

## State interventions and corruption

Effect of public spending – **pub. expenditure (in % GDP)** – and taxation – **tax revenue (in % GDP)** – on bribery.

Variable source: IMF

### Hypothesis testing:

*H4: Corruption will be higher in countries with larger state interventions, because of stronger monopoly and discretionary powers of public agents.*

(Klitgaard, 1988; Lambsdorff, 2005; Tanzi, 1998; La porta et al., 1999)

*H4': Corruption will be lower in countries with larger state interventions, if these interventions result into efficient public goods and service delivery and effective regulation of market-based transactions.*

(Peacock and Scott, 2000; Rodrik, 1998, 2000)

## Openness and corruption

The effect of trade intensity – **trade (in % GDP)** – and natural openness – **remoteness** and **population size** – on bribery

Variables source: WDI, Ferdi.

### Hypothesis testing:

H5: Corruption will be lower in opened economies, since lower trade barriers, higher foreign competition, and larger natural openness are detrimental to corruption.

(Dutt and Traca, 2010; Dutt, 2009; Gatti, 2004; Hellman, et al., 2003; Wei, 2000)

*H5': Corruptiogn will higher in opened economies, since trade openness exposes countries to imported foreign corrupt practices.*

(TI, 2009; Nellis, 2009; Rose-Ackerman, 1996)



## Democracy and corruption

The effect of democracy – **political rights, civil liberties, and press freedom** – on bribery

**Variables source:** Freedom House.

### Hypothesis testing:

H6: Corruption will be lower in democratic countries, because of stronger checks and balances over public decision-making.

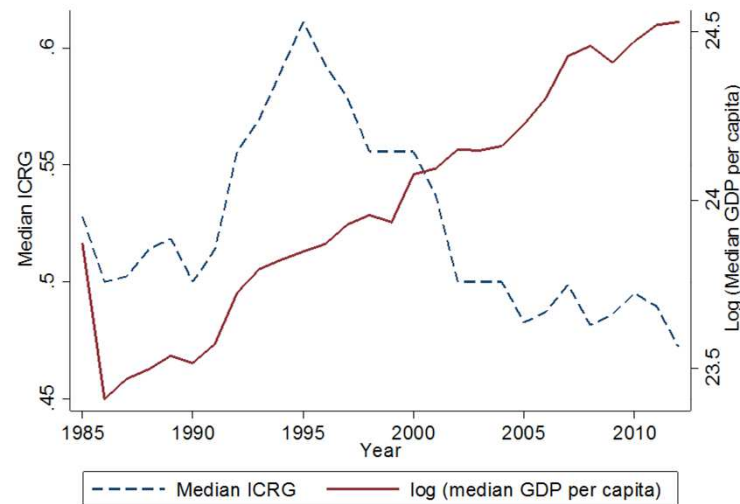
(Lambsdorff, 2002; Treisman, 2000, 2007; Sandholtz and Koetzle, 2000; Bhattacharyya and Hodler, 2010, 2015)

*H6': Corruption will be higher in young democratic countries, if increased civil liberties result into a larger scope for private corrupt transactions and a weaker rule of law.*

(Treisman, 2000, 2007; Sandholtz and Koetzle, 2000)

## Is economic development detrimental to corruption?

*Preliminary evidence from corruption perception data*

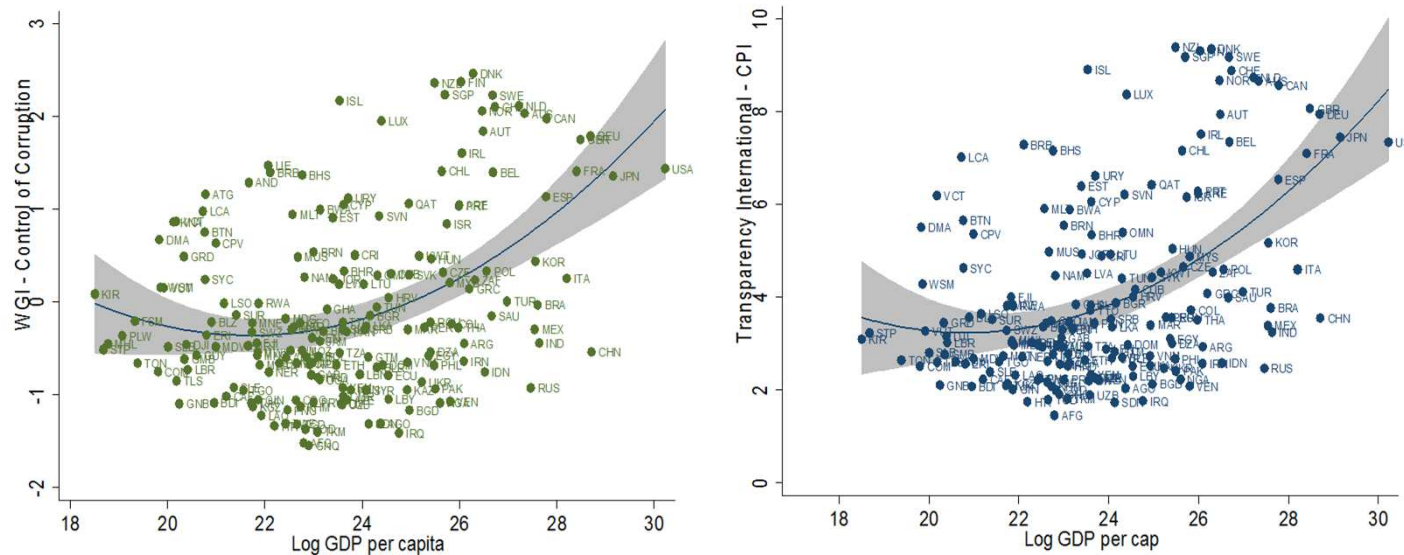


Time correlation between world log GDP per capita and the world corruption perception level (inverted)

At early stages of development, improved living standards may be associated with higher perceptions of corruption

# Is economic development detrimental to corruption?

*Preliminary evidence from corruption perception data*



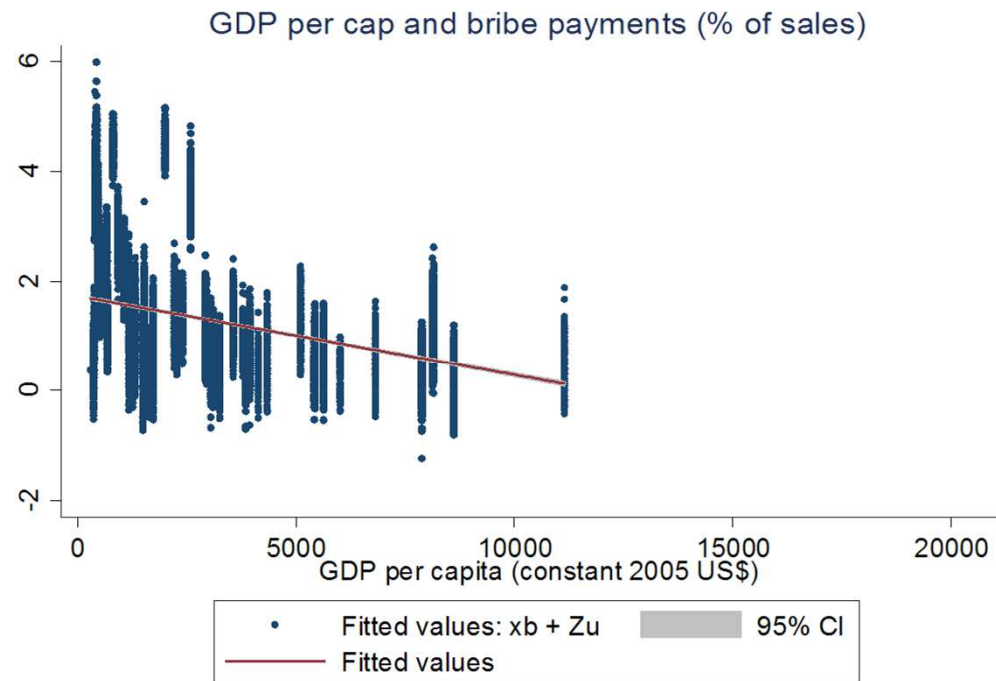
Cross-country correlations between the log GDP per capita and TI&KKM corruption perception levels (TI)

At early stages of development, improved living standards may be associated with higher perceptions of corruption



## Is economic development detrimental to corruption?

A 10% increase in the average GDP per capita results in a 0.67 percentage point decrease in the size informal payments



This evidence does not tell much on the underlying mechanisms...

## Human development and corruption

Table 2. Human Capital and bribery (1)

Dep. Var.	Bribe payments (BP)				Bribe incidence (BI)		BP	BI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP per capita	-0.00003 (0.00007)	-0.00001 (0.00004)	-0.00003 (0.00006)	0.00001 (0.00004)	-0.00002** (0.00001)	-0.00001 (0.00001)	-0.0003*** (0.0001)	-0.00003*** (0.0000)
Fertility rate	0.673*** (0.132)	0.697*** (0.137)	0.652*** (0.131)	0.681*** (0.138)	0.057*** (0.021)	0.067*** (0.028)		
1 <sup>ary</sup> enrollment ratio							-0.013 (0.012)	0.005*** (0.002)
Dummies	Firms sizes & sectors							
	Country-level random effect parameters							
Intercept	0.786***	0.000	0.744***	0.000	0.028***	0.002***	1.086***	0.044***
Slope fertility		0.062***		0.061***		0.020**		
	Sector-level random effect parameters							
Intercept	0.000	0.000	0.000	0.000	0.001***	0.001***	0.008***	0.001***
Slope fertility			0.007***	0.007*				
R2 / Wald Stat	166.5***	154.7***	157.8***	146.9***	143.2***	130.6***	137.4***	143.7***
LR Chi2	342.4***	354.9***	348.8***	360.7***	2935.8***	2946.2***	434.0***	2601.9***
#Countries (#obs)	40(18.052)							

Controls not reported. Standard errors in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

## Human development and corruption

Table 3. Human Capital and bribery (2)

Dep. Var.	Bribe payments			Bribe incidence		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP <i>per capita</i>	-0.00005 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.00001 (0.0001)	-0.000 (0.0001)	-0.000 (0.0001)
Fertility rate	0.668*** (0.126)	0.681*** (0.130)	0.675*** (0.126)	0.005*** (0.002)	-0.758*** (0.328)	-0.071 (0.160)
Primary enrolment ratio	-0.015 (0.011)	-0.017* (0.010)	-0.013 (0.010)	0.059*** (0.024)	0.044*** (0.015)	0.003 (0.011)
Public exp. education			-0.246*** (0.075)			0.212** (0.93)
Dummies	Firms sizes & sectors					
	Country-level random effects					
Intercept	0.691***	0.000	0.000	0.038***	8.503***	0.000
Slope fertility		0.053***	0.049***		1.126***	0.159***
Slope pub. exp. edu.						0.065***
	Sector-level random effects					
Intercept	0.000	0.000	0.000	0.001***	0.001***	0.001***
Slope fertility		0.007**	0.006**			
R2 / Wald Stat	163.9***	152.7***	165.2***	149.3***	116.7***	109.5***
LR Chi2	269.4***	301.4***	311.5***	2449.4***	2761.7***	2841.4***
#Countries (#Firms)	40(18.052)					

Controls not reported. Standard errors in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Public spending is a significant channel of the effect of human development on corruption incidence

## State interventions and corruption

Dep. Var.:	BP	BI
	(12)	(13)
<i>GDP per capita</i>	-0.0002*** (0.0000)	-0.00003** (0.0001)
Public spending	0.098* (0.059)	0.009* (0.006)
Tax revenue (a)	-0.301* (0.172)	-0.045*** (0.020)
<b>Country-level random effect parameters</b>		
Intercept	0.000	0.035
Slope Pub. spend.	0.09***	0.001***
Slope Tax rev.	0.518***	0.004***
<b>Sector-level random effect parameters</b>		
Intercept	0.000	0.001***
Slope Pub. spend.	0.002***	
R2 / Wald Stat	120.7***	169.5***
LR Chi2	834.8***	4770.3***
#Countries (#Firms)	50(26.662)	

Controls not reported. Standard errors in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%. (a) General goods and services tax revenue.



## Final estimations

**Table 8. Country determinants of bribery**

Dep. Var.	Bribe payments		Bribe incidence	
	(1)	(2)	(3)	(4)
GDP <i>per capita</i>	0.0002** (0.0001)	0.0004 (0.0003)	0.0003*** (0.0000)	0.0000 (0.000)
Fertility rate	0.556*** (0.208)	1.017* (0.570)	-0.013*** (0.004)	0.088* (0.054)
Primary enrolment ratio	0.059*** (0.019)	0.081 (0.050)	0.197** (0.095)	0.006 (0.004)
Public spending	0.009 (0.013)	0.022 (0.040)	-0.006*** (0.002)	0.008 (0.006)
Tax revenue	-0.544*** (0.137)	-1.107*** (0.371)	-0.294*** (0.034)	-0.057* (0.032)
Trade (% of GDP)	0.001 (0.010)	0.011 (0.026)	0.006*** (0.001)	0.002 (0.002)
Remoteness index	0.021 (0.019)	0.121** (0.058)	0.037*** (0.010)	0.005 (0.005)
Log population	0.007 (0.088)	0.002 (0.245)	-0.123** (0.059)	0.003 (0.021)
FotP scores	-0.073*** (0.019)	-0.143*** (0.046)	-0.037*** (0.003)	-0.005 (0.004)
PR scores	0.003 (0.240)	0.479 (0.509)	-0.149*** (0.027)	-0.113* (0.057)
CL scores	1.019*** (0.239)	1.219** (0.591)	0.231*** (0.030)	0.168** (0.076)
Durability	-0.045** (0.022)	-0.026 (0.058)	-0.052*** (0.007)	-0.002 (0.005)
Dummies	Firms sizes & sectors			
	<b>Country-level random effects</b>			
Intercept	2.409***	10.00***	1.226***	0.025
Slope pub. spend.		0.017*		0.0007*
Slope tax. Rev.		0.493***		0.003***
	<b>Sector-level random effects</b>			
Intercept	0.166***	0.000	0.002***	0.001***
Slope Trade		0.00004***		
Wald Stat	222.6***	139.8***	586.5***	169.1***
LR Chi2	344.9***	445.0***	2244.4	2550.0***
#Countries (#Firms)	40(22,011)			

Firm-level controls not included. Standard errors in parenthesis. \*significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

- **Unobserved heterogeneity** in the slope coefficients of policy related variables induces a downward bias in the estimated variance and effect of other corruption determinants.
- Random slope components reverse the sign of the effect of fertility on bribery incidence
- The modalities by which state interventions affect corruption levels need to be further explored

## Final estimations

### Human development

- Raising the fertility rate by one child per women increases bribe payments by around 1 percentage point, and would therefore almost double bribe prevalence in the baseline sample.

### State interventions

- Raising by 10% tax revenue reduces bribe payments by 0.57 percentage point, and would therefore cut by a half bribe prevalence in the baseline sample.

### Natural openness

- A 10% increase in the remoteness index is associated with a 0.77 percentage point higher average bribe payment, and would there reduce by more than a half bribe payments in the baseline sample.

### Democracy

- A 10 index-point increase in the FotP index (index between 0 and 100) leads to 1.4 percentage point decrease in bribe payments, while a 1 point increase in the CL (index between 1 and 7) index leads to a 1.2 percentage point increase in bribe payments.

No more significant effects of GDP per capita, schooling, public spending on bribery once controlling for **unobserved heterogeneity in policy-related variables.**

# CONCLUSION

- This paper proposes a review of key country determinants of corruption, based on a multi-level analysis of bribe prevalence.
- Multi-level estimates confirm that income *per cap* significantly reduces bribe prevalence.
- (Intermediary) estimations also stress that this negative effect of income is found to be mostly explained by human development, especially fertility rates, and to mostly hold in democracies.
- The effect of human development and trade intensity depends on state interventions and democracy.
- Unobserved heterogeneity in the slope of policy-related variables, especially taxation, strongly affects the estimated variance and coefficients of other corruption determinants.
- Multi-level modelling of bribery data helps avoiding spurious conclusions regarding the direction, the significance and the strength of some relationships.

**Thank you.**