The Internet and Corruption: Evidence from Cross-Country Panel Data

인터넷과 부패: 국별 패널자료를 중심으로

Changkyu Choi(최창규)*·Jae-Hyung Lee(이재형)**·Myung Hoon Yi(이명훈)***[1)]

국문초록

1998년부터 2004년까지의 국별 패널자료로 pooled OLS와 panel GMM 추정법을 사용하여 분석한 결과, 인터넷 사용자가 많아질수록 그 나라의 부패수준이 낮아진다는 것을 발견하였다. 그 외에도 그 나라의 1인당 GDP가 증가할수록 부패수준이 낮아지는 것으로 나타났다. 또한 규제가 많고, 경제적 자유가 낮을수록 부패는 증가하는 것으로 분석되었다. 따라서 향후 인터넷이 광범위하게 사용된다면 그 사회의 부패가 낮아지는 결과를 가져올 것으로 예상된다.

JEL classification: D73; L86
주제어: 인터넷, 부패, 패널자료

1. Motivation

Recently, several studies have been done on the effect of the Internet on economic variables. For example, Choi (2003) and Freund and Weinhold (2004) proved that the Internet attracts the foreign direct investment and international trade, respectively. Yi and Choi (2005) showed that the use of the Internet lowers the inflation rate using cross-country panel data. In this paper, we investigate the effect of the Internet on the level of corruption.

Vinod (1999) claimed that innovative uses of the Internet for information exchange are hopeful new tools to fight corruption. Zinnbauer (2003) asserted that the Internet provides advanced options for cross-checking sources. Together with

* Department of Economics, Myongji University
** School of Liberal Arts, Woosuk University
*** Corresponding author, Department of Economics, Myongji University

digital archiving functions, it also raises the likelihood of ex-post discovery and thus the disciplinary power of transparency. Given that transparency is negatively associated with corruption, it turns out that technological progress reduces corruption. Sturges (2004) also predicted that the use of the Internet contributes to the development of generally applicable principles to reduce corruption.[1] More recently Elgin (2013) found that the Internet usage and shadow economy size strongly interacts with the GDP per capita. In this respect we hypothesize that use of the Internet is associated with lower level of corruption.

However, it is also possible that the Internet may induce corruption. The Internet may boost moral corruption by facilitating the illegal downloading of MP3 music files or pirate copies of films (Killick and Starr, 2000).

Although there are lots of papers on the determinants of corruption (Elbahnasawy and Revier (2012), Lorenzo and Gerlagh (2008), Serra (2006), etc.), to my knowledge our paper is the first paper which includes the Internet variable as one of the determinants of corruption. Therefore theoretically the Internet can either increase or decrease the level of corruption. Thus, it is an empirical question whether the use of Internet will decrease corruption. To this question, we use cross-country panel data over 1998-2004. To our knowledge, however, none have shown empirical evidence on the relationship between use of the Internet and corruption.

We organize the rest of the paper as follows. Section 2 develops the analytical framework that highlights the effect of the Internet on corruption. Section 3 describes the data. Section 4 presents and discusses the empirical results. Section 5 concludes the paper.

2. Model

To analyse the effect of the Internet on corruption, we included use of the Internet, per capita GDP, regulation, and economic freedom as explanatory variables in our corruption equation. For estimation, we set up the following log-linear equation,

1) Sturges (2004) elaborated what transparency means in terms of establishing a polity in which corruption will not thrive.

$$\log(CPI)_{it} = \beta_0 + \beta_1 \log(Internet)_{it} + \beta_2 X_{it} + u_{it} \quad (1)$$

where i and t stand for individual countries and years, respectively. CPI stands for the corruption perception index. To avoid confusion, we would like to interpret CPI as 'Corruption Purity Index' as suggested in Vinod (1999). Internet represents the number of Internet users. Vector Xit includes the control variables: per capita GDP (PGDP), regulation index (REG), and economic freedom (ECOFREE).

3. Data

All the data except per capita GDP covers from 1998 to 2004. Per capita GDP covers from 1998 to 2003. CPI, ranging from 0 to 10, is from Transparency International. A higher CPI is associated with a relatively higher level of purity or lower level of corruption. Internet means the Internet users per 1,000 persons and is taken from the World Development Indicators of the World Bank. PGDP is the per capita GDP from the Human Development Report of the United Nations Development Program (UNDP) and is converted with exchange rates based on Purchasing Power Parity. REG is the regulation index, scaled from 0 to 5, from the Index of Economic Freedom, Heritage Organization. A higher value of REG is associated with more regulation. ECOFREE is the economic freedom index, scaled from 0 to 5, from the Index of Economic Freedom, Heritage Organization. It should be noted that a higher value of ECOFREE is associated with a relatively lower level of economic freedom. Descriptive statistics are listed in Table 1.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Internet	680	147.1735	176.3044	1	820
CPI	680	4.639853	2.371881	0.4	10
PGDP	529	11640.38	10599.74	501	62298
REG	666	3.226727	0.859064	1	5
ECOFREE	661	2.877042	0.701685	1.34	4.625

4. Empirical results

Table 2 lists the pooled ordinary least squares (OLS) results. All the estimated coefficients of the Internet users in Equations (a)–(d) are positive and significant at the 1% level, where a higher CPI is associated with a lower level of corruption. This implies that the widespread use of the Internet reduces corruption. To check robustness, control variables were added to Equations (b)–(d). Per capita GDP (PGDP) is added to Equation (b). As per capita GDP increases, the CPI increases and thus corruption decreases at the 1% significance level. This implies that richer countries have less corruption. Per capita GDP and the regulation index (REG) are added in Equation (c). The coefficient of PGDP is also positive and significant at the 1% level, and that of REG is negative and significant at the 1% level. This implies that increasing regulation increases corruption. In Equation (d) ECOFREE is simply substituted for REG in Equation (c) with similar results. The coefficient of ECOFREE is negative and significant at the 1% level. This suggests that when economic freedom is high (i.e., lower ECOFREE), corruption decreases (i.e., higher CPI).

Table 2. The Internet and Corruption: Pooled OLS[1,2]

	(a)	(b)	(c)	(d)
Dependent variable	Log(CPI)	Log(CPI)	Log(CPI)	Log(CPI)
Constant	0.816*** (0.045)	−0.810*** (0.225)	−0.012 (0.240)	−0.664** (0.263)
Log(Internet)	0.235*** (0.007)	0.114*** (0.020)	0.097*** (0.020)	0.069*** (0.020)
LogPGDP)		0.222*** (0.031)	0.182*** (0.031)	0.156*** (0.031)
Log(REG)			−0.374*** (0.043)	
Log(EOFREE)				−0.757*** (0.067)
Time dummies included	Yes	Yes	Yes	Yes
R2	0.67	0.71	0.74	0.76
Sample size	680	529	523	519

Notes:
1. ***, **, and, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.
2. Newey and West's (1987) heteroscedasticity and autocorrelation consistent covariance matrix assuming a lag length of one is used for standard errors.

Considering the endogeneity of the Internet variable in the corruption equation, we perform panel Generalized Method of Moments (GMM) estimation in Table 3. GMM estimation is also useful in the presence of serial correlation and heteroscedasticity in error terms. We found that the coefficients of the Internet users in Equations (a) and (b) are positive and significant at the 1% level, whereas those in Equations (c) and (d) are positive and significant at the 5% and 10% levels, respectively. This implies that as the number of the Internet users increases, corruption decreases. All the coefficients of per capita GDP (PGDP) in Equations (a) -(d) are positive and significant at the 1% level. The regulation index (REG) in Equations (a) and (b) and the economic freedom index (ECOFREE) in Equations (c) and (d) are all negative and significant at the 1% level.

Table 3. The Internet and Corruption: Panel GMM[1,2,3]

	(a)	(b)	(c)	(d)
Dependent variable	Log(CPI)	Log(CPI)	Log(CPI)	Log(CPI)
Constant	-0.332 (0.263)	-0.315 (0.307)	0.289 (0.288)	0.182 (0.337)
Log(Internet)	0.076*** (0.021)	0.106*** (0.029)	0.042** (0.021)	0.056* (0.029)
Log(PGDP)	0.219*** (0.034)	0.196*** (0.043)	0.201*** (0.033)	0.199*** (0.043)
Log(REG)	-0.430*** (0.057)	-0.393*** (0.065)		
Log(ECOFREE)			-0.797*** (0.081)	-0.743*** (0.093)
Sample size	424	326	421	324

Notes:
1. ***, **, and, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.
2. All the GMM equations are just identified.
3. Instruments in (a): log(Internet)t-1, log(PGDP)t-1, log(REG)t-1
   Instruments in (b): log(Internet)t-2, log(PGDP)t-2, log(REG)t-2
   Instruments in (c): log(Internet)t-1, log(PGDP)t-1, log(ECOFREE)t-1
   Instruments in (d): log(Internet)t-2, log(PGDP)t-2, log(ECOFREE)t-2

5. Summary and policy implication

Using pooled OLS and panel GMM estimations with cross-country panel data from 1998 to 2004, we found that use of the Internet reduces corruption. Furthermore richer countries prove to be less corrupt. Corruption also increases when the level of regulation increases and economic freedom is low. This result implies that widespread use of the Internet in the future will make society less corrupt.

References

Choi, Changkyu. 2003. “Does the Internet stimulate inward FDI?” *Journal of Policy Modeling* 25, no. 4: 319–26.

Elbahnasawy, Nasr G., and Charles F. Revier. 2012. “The Determinants of corruption: Cross-country –panel-data Analysis.” *Development Economies* 50, no 4: 311–33.

Elgin, Ceyhun. 2013. “Internet Usage and the Shadow Economy: Evidence from panel data.” *Economic Systems* 37, no. 1: 111–21.

Freund, Caroline L., and Diana Weinhold. 2004. “The effect of the Internet on international trade.” *Journal of International Economics* 62, no. 1: 171–89.

Killick, Rob, and Sandy Starr. 2000. “Freedom net.” *Economic Affairs* 62, no. 1: 29–32.

Newey, Whitney K., and Kenneth D. West. 1987. “A simple, positive semi-definite, heteroscedasticity and autocorrelation consistent covariance matrix.” *Econometrica* 55, no. 1: 703–8.

Pellegrini, Lorenzo, and Reyer Gerlagh. 2008. “Causes of corruption: A Survey of Cross-Country Analyses and Extended Results.” *Economics of Governance* 9, no. 3: 245–63.

Serra, Danila. 2006. “Empirical determinants of Corruption: A Sensitivity Analysis.” *Public Choice* 126, no 1–2: 225–56.

Sturges, Paul. 2004. “Corruption, transparency, and a role for ICT?” *International Journal of Information Ethics* 2, no 11: 1–9.

Vinod, Hrishikesh D. 1999. “Statistical analysis of corruption data and using the Internet to reduce corruption.” *Journal of Asian Economics* 10, no 4: 591–603.

Yi, Myung Hoon, and Changkyu Choi. 2005. “The effect of the Internet on inflation: Panel data evidence.” *Journal of Policy Modeling* 27, no 7: 885–9.

Zinnbauer, Dieter. 2003. “Institutional transparency, global governance, and ICT: Why and where to?” Draft Memo, London School of Economics, 1–15.

투고일자 : 2013. 11. 08
수정일자 : 2013. 12. 13
게재일자 : 2013. 12. 24

Abstract

The Internet and Corruption: Evidence from Cross-Country Panel Data

Changkyu Choi(Myongji University)
Jae-Hyung Lee(Woosuk University)
Myung Hoon Yi(Myongji University)

Using pooled OLS and panel GMM estimations with cross-country panel data from 1998 to 2004, we found that the Internet reduces the level of corruption. Furthermore, the richer countries prove to be less corrupt. Corruption also increases when the level of regulation increases and economic freedom is low. This result implies that the widespread use of the Internet in the future will make the society less corrupt.

JEL classification: D73; L86
Keywords: The Internet, Corruption, Panel data