4. The Effect of Corruption on the Manufacturing Sectors in India

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1. Introduction

This article investigates the effects of corruption on the performance of the three-digit manufacturing sectors in India. We address the underreporting problem, employ conviction rates of corruption-related cases as an instrument for the extent of corruption, and examine the impact of corruption on the gross value added per worker, capital-labor ratio, and total factor productivity of the three-digit manufacturing sector in each state. Our estimation results show that corruption adversely affects gross value added per worker and total factor productivity.

It has been well recognized, at least since Krueger (1974) and Rose-Ackerman (1978), that corruption may deteriorate the performance of economic activities.[1,2] Previous studies have pointed out several channels through which corruption adversely affects economic performance.[3] First, corruption deteriorates the efficiency of the public sector, because corrupt public officials would choose private contractors who are willing to pay generous bribes instead of those who attain the highest efficiency, and would also misallocate public investments towards sectors where they expect to receive the largest amount of bribes, for instance, military expenditures and large-scale construction projects (see, e.g., Tanzi and Davoodi, 1997, 2002a, 2002b; Gupta, De Mello, and Sharan, 2001).[4] In addition, public officials may purposefully delay their processes in order to elicit bribe payments (e.g., Kaufmann, 1997). Second, corruption distorts the people's choice of occupation. If corruption provides public officials with lucrative opportunities for higher earnings, competent people may choose to become public officials rather than engage in some other value-creating business (e.g., Shleifer and Vishny, 1993; Acemoglu and Verdier, 1998, 2000). Third, corruption pushes business into unofficial sectors, where transactions are more costly and uncertain, which would induce inefficiency (Johnson, Kaufmann, and Shleifer, 1997; Johnson,

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[1] Some earlier studies claim that corruption has some desirable effects, namely, that corruption could speed up bureaucratic processes which would otherwise be very slow (see, e.g., Leff, 1964; Leys, 1970; Lui, 1985). Such arguments have been refuted by many scholars (e.g., Kaufmann, 1997), and have not been supported by later empirical studies. However, some recent studies show that in countries with inefficient bureaucracy, corruption offsets negative effects of entry regulation or has positive effects on entry of firms (Klapper, Laeven, and Rajan, 2006; Dreher and Gassebner, 2008).

[2] In addition to the effect on economic performance, corruption has been shown to affect other social indicators such as literacy rates, elementary school dropout rates, infant mortality rates, and so forth (e.g., Kaufmann, Kraay, and Zoido Lobaton, 1999; Gupta, Davoodi, and Tiongson, 2002).

[3] Jain (2001), Dreher and Herzfeld (2005), and Lambsdorff (2006) provide excellent surveys of the literature. See also Aidt (2003) for a survey of the theoretical arguments.

[4] As the other side of the same coin, Mauro (1997, 1998), Gupta, Davoodi, and Tiongson (2002), Delavallade (2006), and de la Croix and Delavallade (2009) show that corruption reduces public expenditures on education or health.

Kaufmann, and Zoido-Lobaton, 1998).[5] Fourth, corruption deteriorates the performance of the corporate sectors. Corruption may reduce efforts and investments by entrepreneurs in productivity-enhancing technology and physical/human capital, because corruption raises the costs necessary for doing business and induces uncertainty with respect to future returns from investments (Brunetti and Weder, 1998; Brunetti, Kisunko, and Weder, 1998; Brunetti and Weder, 1998; Campos, Lien, and Pradhan, 1999; Wei, 2000).[6,7]

This study empirically tests this fourth effect, namely the adverse effects of corruption on the performance of the corporate sectors. The literature has consistently shown that corruption has detrimental effects on investment rates (e.g., Mauro, 1995; Brunetti, Kisunko, and Weder, 1998; Campos et al., 1999; Gyimah-Brempong, 2002). Other scholars have, though less consistently, shown that economic growth rates are adversely affected by corruption (e.g., Ehrlich and Lui, 1999; Kaufmann, Kraay, and Zoido-Lobaton, 1999; Welsch, 2004). A few studies have related corruption to GDP per capita. Among others, Hall and Jones (1999) show in their cross-national analysis that the lower the measure of social infrastructure, which they construct by taking corruption into account,[8] the lower the log output per worker. Kaufmann, Kraay, and Zoido-Lobaton (1999) constructed indices of governance of countries, which were later developed into World Governance Indicators, and presented evidence that as their measure of corruption worsens, log GDP per capita declines.[9] Output per worker or GDP per capita, however, could also influence the level of corruption of a country, and the endogeneity problem should thus be addressed by, for example, the instrumental variable estimation method. Hall and Jones (1999) and Kaufmann, Kraay, and Zoido-Lobaton (1999) both employ the fraction of the population speaking English and the fraction of the population speaking a major European language (English, French, German, Portuguese, or Spanish) as instrumental variables. However, some scholars have cast

[5] Other channels pointed out in the literature include the following. Corruption lowers inward foreign direct investment, and shifts the ownership structures towards joint ventures (Wei, 2000; Smarzynska and Wei, 2000). Corruption is also shown to increase income inequality (e.g., Gupta, Davoodi, and Alonso-Terme, 2002), inflation rate (e.g., Al-Marhubi, 2000), political instability (e.g., Mo, 2001), restrictions on capital flows (e.g., Dreher and Siemers, 2009), and aid flows (e.g., Alesina and Weder, 2002).

[6] However, Rock and Bonnet (2004) show that in large East Asian countries, higher corruption is correlated with higher economic growth rates.

[7] The most recent studies on the consequences of corruption examine the conditions under which corruption exerts any influence on outcomes. Among others, de la Croix and Delavallade (2009) show that in developing countries with high predatory technology, corruption tends to lower public expenditures on education and health. Meon and Sekkat (2005) show that corruption has detrimental effects on economic growth and investment only in countries with a lower level of governance in terms of rule of law and government effectiveness. Haque and Kneller (2009) theoretically show that there exist thresholds in GDP per capita wherein the relationship between corruption and economic development differs, and present some empirical findings of such thresholds.

[8] Hall and Jones (1999) consider two elements in constructing the measure of social infrastructure. The first element includes five subelements, one of which is corruption. The other four subelements are law and order, bureaucratic quality, risk of expropriation, and government repudiation of contracts.

[9] Wyatt (2002) also confirms that the measure of corruption in the governance indicators of Kaufmann, Kraay, and Zoido-Lobaton (1999) significantly affects GDP per capita, while they also show that the measures of government effectiveness and rule of law in their governance indicators significantly influence the extent of corruption.

doubt on the validity of these instrumental variables (e.g., Lamsdorff, 2006).[10] While instrumental variables must be correlated with the extent of corruption, but not with GDP per capita, the fraction of the population speaking a major European language plausibly affects GDP per capita through other channels than corruption, such as political instability, inequality, unsecure property rights, human capital, and social capital, and so forth. Because of the difficulty of availing of appropriate instruments, studies concerning the impact of corruption on productivity measures such as GDP per capita or gross value added per worker are relatively scarce. However, these variables are closely related to the materialistic well-being of the people and also to social indicators such as life expectancy and infant mortality rates (Ray, 1998), and it is thus worthwhile investigating the effects of corruption on such productivity measures.

The present study focuses on gross value added per worker, as well as its decomposed factors (capital-labor ratio and total factor productivity), and employs conviction rates of corruption-related cases, which have not been used to date as an instrument for corruption. Conviction rates of corruption-related cases may influence the level of corruption by affecting the expected returns from corruption for public officials, but conviction rates do not seem to affect the performance of the three-digit manufacturing sectors through channels other than corruption. Furthermore, the performance of the three-digit manufacturing sectors is presumed to not affect conviction rates of corruption-related cases.

Another issue in the literature is the validity of the variables capturing corruption. Recently, several studies have criticized perception-based corruption indices for their serious bias (Mocan, 2004; Abramo, 2005; Andvig, 2005; Svennson, 2005; Razafindrakoto and Routboud, 2006). For example, critics say that respondents evaluate the extent of corruption based on past experiences, so their assessment changes slowly and does not reflect the present extent of corruption. Moreover, a respondent who has read reports concerning the serious corruption of the country in the past may be affected by the information thereafter. Olken (2009) shows that there exists a gap between the perception regarding the extent of corruption and the reality of corruption in Indonesian villages. The assessments may also suffer from subjectivity because of differences in respondents' personal characters or backgrounds. Moreover, it is known that vulnerability to corruption differs from one industry to another, and the extent of corruption varies from one region to another within a country; therefore, evaluations by individuals who have knowledge limited to specific industries and regions may be biased with respect to the extent of corruption over the whole country.[11]

In order to complement the previous cross-country studies using a perception-based corruption index, we measure the extent of corruption by the official number of cases related to violations of the anti-corruption law. The use of data on such corruption-related cases has some advantages. First, the number does not depend on any subjective assessments by particular

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[10] Because of the endogeneity problem, Lambsdorff (2003) chooses the ratio of GDP to capital stock as a dependent variable, which suffers less from endogeneity, and shows that corruption reduces the ratio.

[11] In response to this situation, an innovative paper by Dreher, Kotsogiannis, and McCorriston (2007) estimate a structural equation model with corruption as a latent variable, in order to obtain a new index of corruption. Olken (2006) more directly calculates the extent of corruption by using accounting data on road projects and survey data on necessary costs for implementing these projects in Indonesian villages.

individuals. Second, we can obtain reasonable instrumental variables for the number of corruption-related crime cases. As mentioned, we employ as our instrument the conviction rate of corruption-related crime cases in courts. Third, by using the variable, we can more reasonably conduct panel data estimation than have previous cross-country studies using a perception-based corruption index. For instance, Transparency International utilizes different sources to compose the Corruption Perceptions Index due to the availability of data across years and countries. For instance, the Corruption Perceptions Index for India in 2004 is based on data from 15 surveys, while the CPI in 2010 is based on 10 surveys. Thus, time-series analysis based on the CPI is difficult to justify. For this reason, many previous studies using the CPI have conducted cross-national analysis. However, cross-national studies can produce biased results because they do not properly control for unobserved time-invariant country characteristics, which can be controlled for by panel data analysis.[12] In this regard, the data on the incidence of corruption-related cases provides useful cardinal measures of corruption to capture the time-series effects of corruption.

An obvious and serious disadvantage of such official corruption data is inaccuracy in the reporting of crimes. This is the main reason that official corruption data has rarely been used in the literature. Criminologist Marenin (1997) is concerned about the reliability of cross-country comparisons of crime data because the propensity for reporting and recordkeeping varies among countries. The International Crime Victimization Surveys (1996/97) show the difference among some developing countries in the propensity to report corruption. Its table 33 (p. 92) shows that the rate of reporting in Paraguay is 8.9%, while it is only 0.7% in Argentina. India is located above the median, showing a reporting rate of 6.3%.

In this study, we address the underreporting problem by employing a method similar to the one proposed by Soares (2004). Soares uses the International Crime Victimization Surveys (denoted by ICVS hereafter), which is a most comprehensive international survey regarding crime victimization covering more than 300,000 people in 78 countries by its fifth survey in 2004/05. He regresses the reporting rates of various crimes on several relevant variables. He then applies the estimation results to official crime data to obtain predicted true crime rates. We adopt an approach similar to his method and address the underreporting problem in the official data on the incidence of corruption.

There are several articles that use corruption-related crime data. For instance, Goel and Rich (1989) used data on the number of public officials convicted of bribery, and Goel and Nelson (1998) used data on the number of public officials convicted of abuse of public office, and they showed some determinants of corruption. Glaeser and Saks (2006) also utilized the number of public officials convicted of a corruption-related crime in each state, found some determinants of

[12] Another index that has been often used in the literature is the index for *control of corruption* in World Governance Indicators. The index designates the position of a country on the hypothetical normal distribution with respect to *control of corruption* among all the sample countries. Thus, a change in the position of a country over time reflects the relative change of the country's position, but does not capture any meaningful cardinal change in the extent of corruption control.

the state corruption level, and presented evidence of the negative effects of corruption on gross state product and median household income.[13] These articles, however, do not carefully address the underreporting problem. Our study complements these studies using official corruption data, by addressing the problem of underreporting.

The definition of corruption is hardly uniform across different countries, cultures, laws, and business practices (see, e.g., Philp, 1997; Gardiner, 2002), and generally speaking, we could expect that the interpretation of the meaning of "corruption" is less variable between regions in one country than across countries. From this viewpoint, it is worthwhile examining the effects of corruption by comparing regions within one country, in this case, India.[14] The rationale for choosing India for our study is that it has undertaken deregulation since the middle of the 1980s, including industry delicensing and trade liberalization, which are considered to have deterrent effects of corruption (see, e.g., Ades and Di Tella, 1997). Thus, it is meaningful to take the sample period from the late 1980s to the 1990s to examine the effects of corruption.

As another rationale for the choice of India, it has been reported to be burdened with an abundance of corruption (see, e.g., Transparency International, 2002; Transparency International India, 2005, 2008; Bertrand et al., 2007). Among six World Governance Indicators compiled by Kaufmann, Kraay, and Mastruzzi (2008), the position of India with respect to *control of corruption* on a standard normal distribution is -0.39, below the mean zero, which indicates that India is more or less plagued by corruption. Moreover, the "Doing Business" project, conducted by the World Bank, provides indicators on 10 fields related to business environments, among which the indicators on *starting a business* and *dealing with licenses* are closely related to corruption. Among 178 countries covered in Doing Business 2008, India ranks 111th in the indicator of *starting a business* and 134th in the indicator of *dealing with licenses*, even after the sequence of delicensing since the 1980s. There seems no doubt that corporate actors in India suffer from corruption, and it is thus meaningful to study the effects of corruption on productivity in India.

Finally, we note the importance of regional diversity in the extent of corruption within a country. Previous cross-national analyses have related the extent of corruption at the national level to national economic performance. However, if there is a large diversity in corruption within a country, entrepreneurs could avoid corrupt regions and locate themselves in less corrupt regions, and the effects of corruption on corporate sectors should thus be more sharply observed across regions in a country.[15] It has been reported that there is a huge diversity across Indian states with respect to business climates including corruption. The Firm Analysis and Competitiveness Survey (FACS) conducted by the World Bank investigates inter-state differences in business climate in India.[16] Some of the results are explained by Veermani and Goldar (2005), who show in their

[13] All these articles use the conviction data for the states in the U.S.

[14] Although limiting the sample to India makes it difficult to generalize the estimation results to other countries, it would provide a useful robustness check for previous cross-national studies.

[15] Although their primary concern is not with corruption, Aghion et al. (2008) show that after the deregulation of three-digit industries, firms invested more in the states where labor regulation is more pro-employer in India.

[16] Questions under 11.3 and 11.5 in the FACS questionnaire are closely related to corruption. See CII and the World Bank (2005) at http://microdata.worldbank.org/enterprise/index.php/ddibrowser/279/download/1617.

table 1 (p. 2414) that investment climates differ substantially from one state to another. Another study by the Rajiv Gandhi Institute for Contemporary Studies (Debroy and Bhandari, 2005) constructed several indices related to the extent of freedom in each state of India. Among the indices, the *regulation of credit, labor, and business* indicator is the one most directly related to corruption since the authors considered corruption in composing this indicator. The table for this indicator in their report (p. 21) shows diversity of the index across Indian states. From these studies, we can see that there exists diversity in terms of the extent of corruption among Indian states. We examine the effects of such difference in the extent of corruption.[17]

The rest of this article investigates the effects of corruption on three economic performance variables of the three-digit manufacturing sectors at the Indian state level. As mentioned already, we conduct instrumental variable estimations. Our estimation results show that corruption adversely affects gross value added per worker and total factor productivity, but not the capital-labor ratio. Moreover, we extend our basic empirical formulation to two groups of industries classified by the average firm size (measured by capital stock per factory). We presume that large firms can deal better with corrupt public officials to their advantage. For instance, large firms may offer large amounts of bribes to powerful politicians or officials to create business conditions advantageous to them. On the other hand, small firms are likely to fall victim to lower-class public officials demanding bribes just to receive normal public services. We show that the deleterious effects of corruption are limited to industries of small average firm size, indicating that large firms are likely to avoid the adverse effects of corruption.

The rest of this article is organized as follows. Our empirical formulation is explained in section 2, followed by the results of instrumental variable estimation in section 3. Section 4 investigates the effects of corruption in different groups divided by average firm size. Section 5 concludes the article.

2. Empirical Formulation

In this study, we examine the effects of corruption on the performance of the three-digit manufacturing sectors at the state level. Corruption may reduce efforts and investments by entrepreneurs in productivity-enhancing technology and physical/human capital. In this section, we examine this channel with respect to the effect of corruption, while other channels, such as misallocation of government expenditure and distorted choice of occupation, are not considered.[18]

2.1. Hypotheses

As explained in section 1, we are interested in the mechanism whereby corruption reduces

[17] Moreover, the studies conducted by Transparency International (2005, 2008) show that there is a huge variety of corruption not only among states but also across different kinds of public services. They have shown that among nine public services, the police and the judiciary are perceived by people to be the most corrupt.

[18] The studies on quantification of the total effects of corruption on various channels, both direct and indirect, have only recently been started. Pellegrini and Gerlagh (2004) and Dreher and Herzfeld (2005) have clarified important channels through which corruption has economic consequences.

efforts and investments by entrepreneurs, leading to lower productivity of the three-digit manufacturing sectors. We capture productivity by gross value added per worker as well as its decomposed factors, the capital-labor ratio and total factor productivity.

First, with respect to total factor productivity, since corruption lowers the expected returns from corporate activities, corruption may reduce efforts and investments by entrepreneurs in productivity-enhancing technology and physical/human capital. Corruption also diverts the time and attention of entrepreneurs from productivity-enhancing efforts towards dealing with corrupt public officials. Thus, we hypothesize that corruption reduces total factor productivity.

Second, with respect to the capital-labor ratio, the effect of corruption on the ratio is theoretically ambiguous. Corruption may reduce capital stock, because firms were required to obtain a license for expansion of capital in India up to 1991, and this provided opportunities for bribe-taking. On the other hand, corruption may raise capital stock because it is easier for firm managers to get kickbacks from suppliers through the purchase of expensive high-quality and custom-made machinery, rather than competitive common machinery that has obvious reference prices (see the example of a bottle-making factory in Mozambique in Shleifer and Vishny, 1993). The effect of corruption on labor employment is not unambiguous, either. Direct effects are not obvious, because labor employment does not seem to provide lucrative opportunities for corruption. Relative advantages of capital in comparison to labor for bribe-taking public officials or firm managers indirectly affect the capital-labor ratio. Hence, the capital-labor ratio may be affected mainly by the attractiveness of capital relative to labor in terms of corruption. The size of the effect is subject to empirical analysis.

Since gross value added per worker is the weighted sum of the capital-labor ratio and total factor productivity, the total effects of corruption on gross value added per worker are also subject to empirical analysis.

2.2. Empirical Methodology

In this study, we pay attention to the effect of corruption on value added per worker (in log terms) as our primary focus. It is known that a constant returns to scale Cobb-Douglass value added production function,

$$Y = AK^{\alpha} L^{1-\alpha} ,$$

can be transformed under certain conditions into

$$\ln \frac{Y}{L} = \ln A + \alpha \ln \frac{K}{L} ,$$

where Y is value added, K is capital, L is labor, and A is total factor productivity. Thus, we also examine the decomposed effects of corruption on the log capital-labor ratio and log total factor productivity.

Our basic estimation formulation is as follows.

$$Z_{ist} = \alpha + \theta_t + \theta_{js} + \beta X_{st} + Y_{st}{}' \gamma + \varepsilon_{ist} ,$$

where Z_{ist} represents economic performance variables of three-digit manufacturing sector i of state s in year t, X_{st} represents the variable indicating the extent of corruption of state s in year t, and Y_{st} represents the vector of control variables. We adopt the following control variables: electricity sales to ultimate consumers (million KwH) per thousand population (abbreviated to *electricity*), road length per thousand population (abbreviated to *road*) to represent physical infrastructure, primary school enrollment rates (abbreviated to *pschool*), and the incidence of labor disputes per worker (abbreviated to *disp*) to represent human resources. The number of bank branches per thousand population (abbreviated to *bank*) is also included to represent financial resources. Two-digit industry (j)×state dummy θ_{js} and year dummy. θ_t are included in the estimation.[19] Depending on state-specific conditions such as location and natural endowments, the volume of economic activity is influenced. This difference is partly dealt with by state-industry dummy θ_{js}.

We conduct instrumental variable estimation to address the endogeneity problem between corruption and economic performance. On one hand, as more economic activities are conducted, the more opportunities for corruption arise. On the other hand, as the economy of a state develops, the state government can provide more resources to combat corruption. In order to address the endogeneity problem, we use the conviction rate (denoted by *conviction*) as an instrumental variable for *corruption*. The variable *conviction* is constructed as the ratio of the number of convictions in corruption-related cases to the number of corruption-related cases under investigation in that year. If this number is high, public servants may refrain from engaging in corrupt behavior because they may perceive the probability of being caught and punished to be high. We conduct a two-stage least square estimation using this instrumental variable.

2.3. Data and Variable Construction

We use the data on state-level three-digit industries according to the 1987 National Industry Classification (NIC1987) as our sample. We focus on 17 major states, because the availability of corruption data is limited in other states. Our sample period ranges from 1988 to 1997. This period includes both the License Raj and liberalization periods. Our main data source is *Annual Surveys of Industries*, compiled by the Central Statistical Office, Government of India. Because of the editing policy of the Central Statistical Office, it is difficult to extend the data on the three-digit manufacturing sectors beyond 1997 consistently.

[19] It would be desirable to have a dummy variable capturing the combination of state *s* and three-digit manufacturing sector *i*, but the computational cost of an estimation including such a large number of dummy variables, namely, one dummy variable for each combination of state and three-digit manufacturing sector, is not practical on our personal computers. Thus, we settled upon dummies for the combination of two-digit industry *j* and state *s*.

Table 1: Descriptive Statistics

Dependent variables

Variable	No. of observations	Mean	S.D.	Min	Max
gross value added per worker	17461	0.6695645	1.85521	−35.19398	127.4278
capital-labor ratio	17456	263.4665	697.6611	0.0544859	43208.59
total factor productivity	17029	0.0012356	0.0015737	0.000000804	0.0663018

Independent variables

Variable	No. of observations	Mean	S.D.	Min	Max
electricity per population	170	0.2801	0.1629	0.0521	0.7986
road per population	170	2.7899	1.4494	0.8405	7.5415
primary school enrolment rate	165	102.9	18.1	62.3	152.6
disputes per worker	144	0.0446	0.0597	0.0014	0.4563
bank branches per population	170	0.0768	0.0215	0.0435	0.1412
corruption registered per population	156	0.0038	0.0039	0.0000	0.0204

Notes:
gross value added per worker: real gross value added divided by the number of workers.
capital-labor ratio: real capital stock divided by the number of workers.
total factor productivity: TFP index obtained by Levinsohn-Petrin method.
electricity per population: electricity sales to ultimate consumers (million KwH) per population in thousand.
road per population: total road length (km) per population in thousand.
disputes per worker: the number of labor disputes per worker bank barnches per population: the number of bank branches per population in thousand.
corruption registered per population: the number of corruption cases registered divided by populationin thousand

Dependent variables are constructed as follows. First, value added per worker is obtained by dividing deflated gross value added by the number of workers. Second, the capital-labor ratio is calculated by dividing real capital stock by the number of workers. Third, in order to obtain total factor productivity (denoted by TFP hereafter), we apply the Levisohn-Petrin method (Levinsohn and Petrin, 2003) to estimate the value-added production function having log real value added as a dependent variable and log real capital stock and log number of workers as independent variables, using deflated total inputs as a proxy variable. We then insert the estimated coefficients back into the production function and subtract the coefficients times the values of independent variables from the log real value added, so as to obtain log TFP. We then calculate the log TFP index by subtracting the mean log TFP[20] in 1990 from the log TFP (see Good, Nadiri, and Sickles, 1996). Detailed information on the data sources and the construction of the variables used in the estimation is given in the appendix.

Descriptive statistics are shown in table 1. We can infer that there exist huge differences in performances across state-industries. Correlations among variables are shown in table 2. No serious correlations between explanatory variables are found.

[20] The mean log TFP is obtained by inserting the mean values of gross value added, labor, and capital in that year into the estimated production function.

Table 2: Correlations among Variables

	gross value added per worker	capital-labor ratio	total factor productivity	disputes per worker	electricity per population	road per population	primary school enrolment rate	bank branches per population	corruption registered per population	conviction rate
gross value added per worker	1									
capital-labor ratio	0.4538	1								
	(0.0000)									
total factor productivity	0.6351	0.0969	1							
	(0.0000)	(0.0000)								
electricity per population	0.0538	0.0509	0.0552	1						
	(0.0000)	(0.0000)	(0.0000)							
road per population	0.0128	0.0514	−0.0519	−0.0303	1					
	(0.0912)	(0.0000)	(0.0000)	(0.0000)						
disputes per worker	−0.0304	−0.0146	−0.0697	0.0029	−0.0213	1				
	(0.0001)	(0.0561)	(0.0000)	(0.7062)	(0.0053)					
primary school enrolment rate	0.0211	−0.0083	0.0503	0.1403	0.1483	0.0218	1			
	(0.0061)	(0.2819)	(0.0000)	(0.0000)	(0.0000)	(0.0049)				
bank branches per population	0.02	0.0079	−0.02	0.3628	0.3793	−0.0261	0.0802	1		
	(0.0083)	(0.2945)	(0.0089)	(0.0000)	(0.0000)	(0.0006)	(0.0000)			
corruption registered per population	0.0096	0.0108	−0.0289	0.2569	0.1676	−0.0356	−0.2194	0.5271	1	
	(0.2224)	(0.1674)	(0.0003)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
conviction rate	0.011	0.026	0.0174	0.2764	−0.0273	0.0767	−0.0652	−0.0125	−0.0938	1
	(0.1676)	(0.0011)	(0.0301)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0335)	(0.0000)	

Notes: Numbers in parentheses are p-values.
See the notes in Table 1 for explanation of variables.

2.4. Underreporting Problem and Construction of a Corruption Variable

The variable used to capture the extent of corruption is the number of cases registered under the Prevention of Corruption Act, 1988 and related penal codes made available in the annual publication *Crime in India* compiled by the Government of India's Ministry of Home Affairs.

Official data on corruption is generally aggregated from registered corruption cases. However, many corruption cases are not reported to any relevant authority (e.g., police or anti-corruption bureau; it is Central Bureau of Investigation in India) for many reasons. In some cases, both public officials and bribers obtain benefits, damaging only public interests, and thus neither side would report. In other cases, public officials demand payment for the public services that they are obliged to provide, but victims do not report the case because they are afraid of non-fulfillment of the service or even possible revenge by public officials. Thus, we expect that the number of cases registered under the Prevention of Corruption Act is seriously underreported.

To correct this underreporting problem, we adopt a method similar to the one advocated by Soares (2004). Soares tackles the underreporting problem of crimes, which include corruption as a subcategory of crimes. He regresses the reporting rates of crimes on relevant economic and social variables, and applies the estimated results to official crime data in order to obtain predicted true crime rates in a cross-national context. Soares has performed this estimation using the ICVS, which is a most comprehensive international survey regarding crime victims covering more than 300,000 people in 78 countries by its fifth survey in 2004/05. Soares (2004) used this dataset up to its third survey in 1996/97 to estimate the crime reporting rate and obtained predicted true crime rates at the national level. In our study, it would be desirable to use Indian domestic data on the crime reporting rate and apply Soares' (2004) method to estimate the predicted true crime incidence in each Indian state, but we are not aware of such a dataset. So, we first estimate the crime reporting rate using ICVS data, and apply the estimation results to obtain the predicted true state crime incidence in Indian states.

More concretely, we estimate the following simple equation,

$$RR_{it} = c_{ij} + b_{1j}\, GDP_{it} + b_{2j}\, DD_i + e_{ijt},$$

where RR_{it} is the reporting rate of corruption in country i in year t, GDP_{it} is GDP per capita of country i in year t expressed in constant 2000 US dollars, and DD_{it} is a developing country dummy variable of country i.[21] Although Soares (2004) suggests a more complete model including urbanization, education, and inequality as explanatory variables, he ended up with a simple model such as the one here, mainly due to the restriction of data.

We aggregate the reporting rates for each country[22] from more than 180,000 individual survey data in the ICVS up to its fourth survey (2002). We then run the simple OLS regression on the pooled dataset of 66 countries collected over 14 years, obtaining the following results:

$$\underset{(3.72)^{***}}{RR_{it} = 0.018745} + \underset{(2.30)^{**}}{0.00000229}\, GDP_{it} + \underset{(2.18)^{**}}{0.0210076}\, DD_{it},$$

No. of observations = 75, R^2=0.1403, F(2,72)=4.47(p-value=0.0147).

Here, the numbers in parentheses are t-values, and *** and ** indicate 1% and 5% significance, respectively. GDP per capita and the developing country dummy are both statistically significant at the 5% level. According to the result, for instance, the reporting rate of corruption in a developing country with per capita GDP equal to 5000 constant 2000 US dollars in a year is predicted to be equal to 0.018745 + 0.00000229*5000 + 0.0210076 = 0.0512026.

We apply these regression results to Indian states in each year to obtain a prediction of the reporting rate of corruption, where *DD* is set to one for all the states. The mean of the predicted reporting rates across Indian states and sample years is 0.0400789, which indicates that the true incidence of corruption is on average about 25 times as much as the official registered cases. We divide the official data on the incidence of corruption by predicted reporting rates to obtain the

[21] The developing country dummy is set to one for Argentina, Bolivia, Botswana, Brazil, Cambodia, China, Colombia, Costa Rica, Egypt, India, Indonesia, Lesotho, Mozambique, Nigeria, Panama, Paraguay, Philippines, South Africa, Swaziland, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe among sample countries.

[22] For U.K., we add Scotland, Wales, Northern Ireland, and England.

Table 3: Descriptive Statistics of *Corruption*

	No. of observations	mean	s.d	min	max
corruption	139	0.08516	0.0782844	0	0.4476062

Notes: *corruption* is the average over the last two years of predicted true incidence of corruption-related cases per population.

predicted true corruption incidence. We normalize the number by dividing it by the thousand population of each state. Furthermore, we take the average value of this variable over the current and previous periods. We use the variable constructed in this way as our explanatory variable capturing the extent of corruption. This variable is hereafter referred to as *corruption*. Descriptive statistics of *corruption* are given in table 3.

3. Estimation Results

We run the instrumental variable estimation with state fixed effects. Standard errors are heteroskedastically robust. Estimation results are presented in table 4. Panel A shows the first-stage estimation results.[23]. R-squared is reasonable. F-tests reject the null hypothesis that all the coefficients are zero. An underidentification test is conducted with the test statistics, which are chi-squared distributed with degrees of freedom equal to one under the null hypothesis that corruption is underidentified by conviction rates. The test statistic is high with p-values close to zero, indicating that the null hypothesis is rejected. The test statistic for the weak identification test (Wald F-statistic based on Kleibergen and Paap 2006) has values that are far greater than the critical values proposed by Stock and Yogo (2001), indicating that it is unlikely that the conviction rate is a weak instrument for corruption. These results indicate that first-stage estimation has been reasonably performed. The coefficient of *conviction* is significant at the 1% level. The result shows that as the conviction rate increases, *corruption* decreases, suggesting that since a high conviction rate raises the possibility of being caught and punished, the amount of corruption declines.

Panel B presents the second-stage estimation results. R-squared is low in column (1), so we should be cautious about it. F-tests reject the null hypotheses that all the coefficients are zero. The test statistic for the endogeneity test is chi-squared distributed with a degree of freedom equal to one. It is high with p-values close to zero in columns (1) and (3), but not in (2), indicating that corruption is an endogenous variable with respect to gross value added per worker and total factor productivity. The results indicate that corruption is not endogenous with respect to the capital-labor ratio. Moreover, the coefficient of the capital-labor ratio is not significant in the second-stage estimation. Thus, rather than searching for a better formulation for the estimation of the capital-labor ratio, we concentrate on columns (1) and (3).

As seen in column (1), gross value added per worker is seriously deteriorated by corruption. Since the empirical model takes semi-log form, our estimation results imply that a one-unit increase in corruption induces a 3.41-unit decrease in gross value added per worker. Alternatively,

[23] Note that due to the availability of the data on the dependent variable, the number of observations varies depending on the column, and first-stage estimation is thus conducted respectively.

Table 4: Instrumental Variable Estimation Results

First Stage

Dependent variable: *corruption*	(1)			(2)			(3)		
	coefficient	standard error		coefficient	standard error		coefficient	standard error	
conviction (-1)	-0.1654986	(0.0048)	***	-0.1660265	(0.0047)	***	-0.1657006	(0.0048)	***
electricity (-1)	0.0192972	(0.0095)	**	0.0226935	(0.0094)	**	0.0195226	(0.0095)	**
road (-1)	0.0089083	(0.0008)	***	0.0090102	(0.0008)	***	0.0088954	(0.0008)	***
disp (-1)	0.0001249	(0.0001)	**	0.0001296	(0.0001)	**	0.0001238	(0.0001)	**
pschool (-1)	0.0005734	(0.0000)	***	0.0005782	(0.0000)	***	0.0005732	(0.0000)	***
bank (-1)	0.3005847	(0.1669)	*	0.4043452	(0.1649)	**	0.3001122	(0.1670)	*
R^2	0.2322			0.2325			0.2317		
F-Statistics	239.45			245.02			239.77		
p-value	0			0			0		
F-test of excluded instruments	1203.17			1227.8			1205.54		
p-value	0			0					
Underidentification test									
rk LM statistic (p-value)	407.06	(0)		414.96	(0)		408.95	(0)	
Weak identification test									
rk Wald F-statistic	1203.17			1227.798			1205.536		
Stock-Yogo weak ID test critical value: 10% maximal IV size	16.38			16.38			16.38		

Second Stage

dependent variable	(1) log gross value added per worker			(2) log capital labor ratio			(3) log total factor productivity		
corruption	-3.415039	(1.3523)	**	0.3094051	(1.4294)		-3.752656	(1.0823)	***
electricity (-1)	0.2176796	(0.2768)		1.378462	(0.3079)	***	0.2605926	(0.2188)	
road (-1)	0.0120802	(0.0236)		-0.0365443	(0.0256)		0.065094	(0.0185)	***
disp (-1)	0.0015209	(0.0045)		0.0053736	(0.0056)		-0.0062726	(0.0037)	*
pschool (-1)	0.0039172	(0.0013)	***	0.0028	(0.0014)	**	-0.000014	(0.0010)	
bank (-1)	-14.1165	(5.1149)	***	-15.8493	(5.0768)	***	3.056921	(3.9843)	
R^2	0.029			0.1141			0.1377		
F-Statistics	31.49			98.94			143.5		
p-value	0			0			0		
Endogeneity test: chi-sq test statistics	5.59			0.374			13.672		
p-value	0.0181			0.5409			0.0002		
Number of observations	12199			12484			12201		

Notes: *** indicates 1% significant, ** 5%, and * 10%. Numbers in parentheses are heteroskedasiticiy robust standard errors.
See the notes in Table 1 for explanation of variables.

the increase of one standard deviation in *corruption* induces about a 20% decrease in gross value added per worker. It appears that corruption has serious detrimental effects on gross value added per worker. The negative coefficient in column (3) also indicates that corruption reduces total factor productivity. The increase of one standard deviation in *corruption* induces about a 22% decrease in total factor productivity. These findings show the very deleterious effects of corruption on the productivity of firms.

Regarding other variables, *road* has significantly positive coefficients at the 1% significance level for total factor productivity. In column (3), the number of disputes per worker has a negative coefficient at the 10% significance level. This seems to indicate that a cooperative relationship between labor and management is important for total factor productivity. In column (1), the primary school enrolment rate has a positive coefficient at the 1% significance level, which is as expected. In column (1) the numbers of bank branches per population have an unexpected significant negative sign. We suspect that the policy of the Government of India to promote establishment of bank branches in backward areas may have some relevance to this.[24]

In summary, instrumental variable estimation results reveal that corruption has significantly detrimental effects on the gross value added per worker and total factor productivity of the three-digit manufacturing sectors.

Table 5: IV Estimation Results for Small Firm Industries

First Stage

Dependent variable: *corruption*	(1)			(2)			(3)		
	coefficient	standard error		coefficient	standard error		coefficient	standard error	
conviction (−1)	−0.1598522	(0.0053)	***	−0.1606804	(0.0053)	***	−0.1598829	(0.0053)	***
electricity (−1)	0.0262149	(0.0106)	**	0.0294389	(0.0104)	***	0.0262171	(0.0106)	**
road (−1)	0.0102766	(0.0009)	***	0.010356	(0.0009)	***	0.0102766	(0.0009)	***
disp (−1)	0.0001287	(0.0001)	**	0.0001382	(0.0001)	**	0.0001286	(0.0001)	**
pschool (−1)	0.000573	(0.0000)	***	0.0005813	(0.0000)	***	0.0005731	(0.0000)	***
bank (−1)	0.2907892	(0.1872)		0.3947085	(0.1849)	**	0.2906562	(0.1872)	
R^2	0.2291			0.2299			0.2293		
F−Statistics	188.61			193.33			189.63		
p−value	0			0			0		
F−test of excluded instruments	893.81			920.39			899.21		
p−value	0			0			0		
Underidentification test									
rk LM statistic (p−value)	315.04	(0)		323.74	(0)		317.38	(0)	
Weak identification test									
rk Wald F−statistic	893.81			920.391			899.208		
Stock−Yogo weak ID test critical value: 10% maximal IV size	16.38			16.38			16.38		

Second Stage

dependent variable	(1) log gross value added per worker			(2) log capital labor ratio			(3) log total factor productivity		
corruption	−3.456311	1.467734	**	0.6525288	(1.5666)		−4.040801	1.238521	***
electricity (−1)	0.0518462	(0.3076)		1.485816	(0.3338)	***	0.0954906	(0.2481)	
road (−1)	0.0137227	(0.0277)		−0.068649	(0.0295)	**	0.0718899	(0.0223)	***
disp (−1)	0.0026115	(0.0045)		0.0055186	(0.0056)		−0.00607	(0.0037)	
pschool (−1)	0.0040289	(0.0014)	***	0.0018508	(0.0015)		0.0004812	(0.0011)	
bank (−1)	−10.16273	(5.5566)	*	−13.85449	(5.4269)	**	5.837609	(4.3732)	
R^2	0.0212						0.1393		
F−Statistics	19.99			70.27			118.15		
p−value	0			0			0		
Endogeneity test: chi−sq test statistics	5.307			0.525			12.65		
p−value	0.0212			0.4688			0.0004		
Number of observations	10146			10359			10149		

Notes: *** indicates 1% significant, ** 5%, and * 10%. Numbers in parentheses are heteroskedasiticiy robust standard errors.
See the notes in Table 1 for explanation of variables.

[24] From 1977 to 1990, the Reserve Bank of India required organized banks to open four new branches in unbanked areas when they opened one new branch in a banked area.

4. Scale Economies in Dealing with Corruption

The effects of corruption on the corporate sector may vary depending on firm size. A large firm may bribe powerful public officials to obtain preferential treatment in policy implementation, or win in the bidding for large-scale public projects. Small firms are not able to compete in bribing with large firms, and small firms are thus more susceptible to corruption.

In this section, we separate our state-industry (three-digit) observations into the large firm state-industry group and the small firm state-industry group, based on the average size of capital stock per factory of each state-industry. We divide the real capital stock of each three-digit industry

Table 6: Estimation Results for Large Firm Industries

First Stage

Dependent variable: *corruption*	(1)			(2)			(3)		
	coefficient	standard error		coefficient	standard error		coefficient	standard error	
conviction (-1)	-0.1642893	(0.0138)	***	-0.1619747	(0.0137)	***	-0.1644152	(0.0138)	***
electricity (-1)	-0.132167	(0.0301)		-0.008964	(0.0295)		-0.0118425	(0.0302)	
road (-1)	0.0055095	(0.0018)	***	0.0055197	(0.0019)	**	0.0054644	(0.0018)	***
disp (-1)	0.0038568	(0.0019)	**	0.0023761	(0.0021)		0.0037459	(0.0019)	*
pschool (-1)	0.0005207	(0.0001)	***	0.0005054	(0.0001)	***	0.0005233	(0.0001)	***
bank (-1)	0.2725594	(0.4759)		0.4186744	(0.4679)		0.3120369	(0.4765)	
R^2	0.253			0.2504			0.2508		
F-Statistics	26.45			27.55			26.48		
p-value	0			0			0		
F-test of excluded instruments	141.25			140.54			141.38		
p-value	0			0			0		
Underidentification test									
rk LM statistic (p-value)	60.47	(0)		59.87	(0)		60.5	(0)	
Weak identification test									
rk Wald F-statistic	141.25			140.537			141.379		
Stock-Yogo weak ID test critical value: 10% maximal IV size	16.38			16.38			16.38		

Second Stage

	(1)			(2)			(3)		
dependent variable	log gross value added per worker			log capital labor ratio			log total factor productivity		
corruption	-4.815439	3.917738		0.8767837	(3.2520)		-2.111843	2.973421	
electricity (-1)	0.2222778	(0.7137)		1.384917	(0.6437)	**	0.8901858	(0.5482)	
road (-1)	0.0410852	(0.0479)		0.0937477	(0.0472)	**	0.0575578	(0.0381)	
disp (-1)	-0.0541057	(0.1650)		0.2577563	(0.1344)	*	0.1084586	(0.1225)	
pschool (-1)	0.0061277	(0.0033)	*	0.004409	(0.0027)		-0.0009472	(0.0026)	
bank (-1)	-25.20437	(14.9462)	*	1.872998	(11.6962)		-14.54093	(11.2951)	
R^2	0.0433			0.1542			0.1369		
F-Statistics	4.73			13.08			18.81		
p-value	0			0			0		
Endogeneity test: chi-sq test statistics	0.89			0.63			0.437		
p-value	0.3455			0.4272			0.5085		
Number of observations	1701			1769			1703		

Notes: *** indicates 1% significant, ** 5%, and * 10%. Numbers in parentheses are heteroskedasiticiy robust standard errors.
See the notes in Table 1 for explanation of variables.

of a state by the number of factories to obtain the average size of capital stock of a factory (we loosely call this number "average firm size"). Compared with the mean of this average firm size across all state-industry observations during the sample period, a state-industry observation with a larger average firm size is defined as being large-firm state-industry and otherwise as being small-firm state-industry. The endogeneity problem between productivity measures and capital stock per factory is less serious than in the case of using sales or employees as our size variables, because capital stock accumulates over a long time period, and it is more or less determined by technological conditions of industries such as advantages provided by scale economies. Our hypothesis is that in the small-firm state-industry group, corruption adversely affects the performance of the state-industries, while it does not in the large-firm state-industry group.

Tables 5 and 6 show estimation results in the small-firm and large-firm state-industry groups, respectively. The results support our hypothesis. As seen in table 4, for the small-firm state-industry group, the tests for fitness, underidentification, weak identification, and endogeneity for columns (1) and (3) in table 5 are reasonably passed, just as in table 4. Table 5 confirms that *corruption* has detrimental effects on gross value added per worker and total factor productivity, as shown in section 3.[25] One standard deviation (0.0745 for this group) increase in *corruption* induces about a 26% decrease in gross value added per worker and about a 30% decrease in total factor productivity.

However, in the large-firm state-industry group, *corruption* does not exert any statistically significant effects on any performance variables, though the signs of coefficients of gross value added per worker and total factor productivity are negative as before.

Hence, from these results, we conclude that corruption is more likely to deteriorate the performance of industries of small average firm size. This is in accordance with the view that small firms are more susceptible to corruption.

5. Conclusion

We have examined the impact of corruption on performance of the manufacturing sectors at the state level in India. We used the data on the incidence of corruption-related cases as our explanatory variable, and used the conviction rate as an instrumental variable, which have not been used in previous studies. Furthermore, we address the underreporting problem of corruption-related cases by a method similar to Soares (2004). Our estimation results show that corruption seriously reduces gross value added per worker and total factor productivity, but not the capital-labor ratio. Corruption reduces the incentive to invest in physical/human capital and technology. Corruption also diverts the time and efforts of managers/entrepreneurs towards dealing with corrupt public officials, rather than value-creating corporate activities. Moreover, in the extension, we show that small-firm-size industries are adversely affected by corruption, while large-firm-size industries are not. This result indicates that large firms may deal better with

[25] 'Road' has significant positive effects as shown in table 3, but 'disputes per worker' loses its significance.

corruption but that small firms may fall victim to corruption. In summary, this study supports the estimation results of previous studies showing the adverse effects of corruption.

References

Abramo, W. C., *How Far Do Perceptions Go?* Working paper, Transparency Brazil, 2005.

Acemoglu, D., and T. Verdier, "Property Rights, Corruption and the Allocation of Talent: A General Equilibrium Approach," *Economic Journal*, **108**, 1381-1403, 1998.

Acemoglu, D., and T. Verdier, "The Choice between Market Failures and Corruption," *American Economic Review*, **90**, 1:194-211, 2000.

Ades, A., and R. Di Tella, "National Champions and Corruption: Some Unpleasant Interventionist Arithmetic," *Economic Journal*, **107**, 1023-1042, 1997.

Aghion, P., R. Burgess, S. J. Redding, and F. Zilibotti, "The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India," *American Economic Review*, **98**, 1397-1412, 2008.

Aidt, T. S., "Economic Analysis of Corruption: A Survey," *Economic Journal*, **113**, 632-652, 2003.

Alesina, A., and B. Weder, "Do Corrupt Governments Receive Less Foreign Aid?" *American Economic Review*, **92**, 4:1126-1137, 2002.

Al-Marhubi, H., "Corruption and Inflation," *Economic Letters*, **66**, 2:199-202, 2000.

Andvig, J. C., "A House of Straw, Sticks or Bricks? Some Notes on Corruption Empirics," Paper presented at the IV Global Forum on Fighting Corruption and Safeguarding Integrity, Session Measuring Integrity, June 7, 2005.

Betrand, M., S. Djankov, R. Hanna, and S. Mullainathan, "Obtaining a Driver's License in India: An Experimental Approach to Studying Corruption," *Quarterly Journal of Economics*, **122**, 4:1639-1676, 2007.

Brunetti, A., G. Kisunko, and B. Weder, "Credibility of Rules and Economic Growth: Evidence from a Worldwide Private Sector Survey," *World Bank Economic Review*, **12**, 3:353-384, 1998.

Brunetti, A., and B. Weder, "Investment and Institutional Uncertainty: A Comparative Study of Different Uncertainty Measures," *Weltwirtschaftliches Archic*, **134**, 3:513-533, 1998.

Campos, J. E., D. Lien, and S. Pradhan, "The Impact of Corruption on Investments: Predictability Matters," *World Development*, **27**, 6:1059-1067, 1999.

Debroy, B., and L. Bhandari, *Economic Freedom for States of India*. Rajiv Gandhi Institute for Contemporary Studies, 2005.

Delavallade, C., "Corruption and Distribution of Public Spending in Developing Countries," *Journal of Economics and Finance*, **30**, 3:222-239, 2006.

De la Croix, D., and C. Delavallade, "Growth, Public Investment and Corruption with Failing Institutions," *Economics of Governance*, **10**, 187-219, 2009.

Dreher, A., and M. Gassebner, "Greasing the Wheels of Entrepreneurship? The Impact of Regulations and Corruption on Firm Entry," *CESifo Working Paper Series*, **2013**, Munich: CESifo Group, 2008.

Dreher, A., and T. Herzfeld, *The Economic Costs of Corruption: A Survey and New Evidence*. Mimeo, ETH Zurich, 2005.

Dreher, A., C. Kotsogiannis, and S. McCorrison, "Corruption around the World: Evidence from a Structural Model," *Journal of Comparative Economics*, **35**, 3:443-446, 2007.

Dreher, A., and L.-H. R. Siemers, "The Nexus between Corruption and Capital Account Restrictions," *Public Choice*, **140**, 245-265, 2009.

Ehlrich, I., and F. T. Lui, "Bureaucratic Corruption and Endogenous Growth," *Journal of Political Economy*, **107**, 6:270-293, 1999.

Gardiner, J., "Defining Corruption," in M. Johnston and M. Heidenheimer, eds., *Political Corruption: Concepts and Contexts*. 3rd ed. (first published in 1993), New Brunswick, New Jersey: Transaction Publishers, 2002.

Glaeser, E.D., and R.E. Saks, "Corruption in America," *Journal of Public Economics*, **90**, 1053-1072, 2006.

Goel, R. K., and M. A. Nelson, "Corruption and Government Size: A Disaggregated Analysis," *Public Choice*, **97**, 107-120, 1998.

Goel, R. K., and D. P. Rich, “On the Economic Incentives for Taking Bribes,” *Public Choice*, **61**, 269-275, 1989.

Good, D. H., N. I. Nadiri, and R. C. Sickles, “Index Numbers and Factor Demand Approaches to the Estimation of Productivity,” *NBER Working Paper*, **5790**, 1996.

Gupta, S., H. R. Davoodi, and R. Alonso-Terme, “Does Corruption Affect Income Inequality and Poverty?” in G. T. Abed and S. Gupta, eds., *Governance, Corruption, & Economic Performance*. Washington, DC: International Monetary Fund, Publication Services, 458-486, 2002.

Gupta, S., H. R. Davoodi, and E.R. Tiongson, “Corruption and the Provision of Health Care and Education Services,” in G. T. Abed and S. Gupta, eds., *Governance, Corruption, & Economic Performance*. Washington, DC: International Monetary Fund, Publication Services, 254-279, 2002.

Gupta, S., L. De Mello, and R. Sharan, “Corruption and Military Spending,” *European Journal of Political Economy*, **17**, 4:749-777, 2001.

Gymiah-Brempong, K., “Corruption, Economic Growth, and Income Inequality in Africa,” *Economics of Governance*, **3**, 183-209, 2002.

Hall, R. E., and C. I. Jones, “Why Do Some Countries Produce So Much More Output per Worker than Others?” *Quarterly Journal of Economics*, **114**, 83-116, 1999.

Haque, M. E., and R. Kneller, “Corruption Clubs: Endogenous Thresholds in Corruption and Development,” *Economics of Governance*, **10**, 345-373, 2009.

Jain, A. K., “Corruption: A Review,” *Journal of Economic Surveys*, **15**, 1:71-121, 2001.

Johnson, S., D. Kaufmann, and A. Shleifer, “The Unofficial Economy in Transition,” *Brookings Papers on Economic Activity*, **27**, 2:159-239, 1997.

Johnson, S., D. Kaufmann, and P. Zoido-Lobaton, “Regulatory Discretion and the Unofficial Economy,” *American Economic Review*, **88**, 387-392, 1998.

Kaufmann, D., “Corruption: The Facts,” *Foreign Policy*, 114-131, summer 1997.

Kaufmann, D., A. Kraay, and P. Zoido-Lobaton, “Governance Matters,” *World Bank Policy Research Working Paper*, **2196**, Washington, DC, 1999.

Kaufmann, D., A. Kraay, and M. Mastruzzi, “Governance Matters VII: Aggregate and Individual Governance Indicators 1996-2007,” *World Bank Policy Research Working Paper,* **4654**, Washington, DC, 2008.

Klapper, L., L. Laeven, and R. Rajan, “Entry Regulation as a Barrier to Entrepreneurship,” *Journal of Financial Economics*, **82**, 591-629, 2006.

Kleibergen, F., and R. Paap, “Generalized Reduced Rank Tests Using the Singular Value Composition,” *Journal of Econometrics*, **133**, 97-126, 2006.

Krueger, A. O., “The Political Economy of the Rent-Seeking Society,” *American Economic Review*, **64**, 291-303, 1974.

Lambsdorff, J. G., “How Corruption Affects Productivity,” *Kyklos*, **56**, 457-474, 2003.

Lambsdorff, J. G., “Causes and Consequences of Corruption: What Do We Know from a Cross-Section of Countries?” in S. Rose-Ackerman, ed., *International Handbook on the Economics of Corruption*. Edward Elgar Publishing Limited, 3-51, 2006.

Leff, N. H., “Economic Development through Bureaucratic Corruption,” in A. J. Heidenheimer, ed., *Political Corruption: Readings in Comparative Analysis*. New York: Holt Renehart, 8-14, 1964.

Levinsohn, J., and A. Petrin, “Estimating Production Functions Using Inputs to Control for Unobservables,” *Review of Economic Studies*, **70**, 2:317-342, 2003.

Leys, C., “What is the Problem about Corruption?” in A. J. Heidenheimer, ed., *Political Corruption: Readings in Comparative Analysis*. New York: Holt Renehart, 31-37, 1970.

Lui, F., “An Equilibrium Queuing Model of Corruption,” *Journal of Political Economy*, **93**, 760-781, 1985.

Marenin, O., “Victimization Surveys and the Accuracy and Reliability of Official Crime Data in Developing Countries,” *Journal of Criminal Justice*, **25**, 6:463-475, 1997.

Mauro, P., “Corruption and Growth,” *Quarterly Journal of Economics*, **110**, 3:681-712, 1995.

Mauro, P., “The Effects of Corruption on Growth, Investment, and Government Expenditure: A Cross-Country Analysis,” in K. A. Elliot, ed., *Corruption and the Global Economy*. Washington DC: Institute for International Economics, 1997.

Mauro, P., "Corruption and the Composition of Government Expenditure," *Journal of Public Economics*, **69**, 2:263-279, 1998.

Meon, P.-G., and K. Sekkat, "Does Corruption Grease or Sand the Wheels of Growth?" *Public Choice*, **122**, 1/2:69-97, 2005.

Mo, P. H., "Corruption and Economic Growth," *Journal of Comparative Economics*, **29**, 1:66-79, 2001.

Mocan, N., "What Determines Corruption? International Evidence from Micro Data," *NBER Working Paper*, **10460**, 2004.

Olken, B. A., "Corruption and the Costs of Redistribution: Micro Evidence from Indonesia," *Journal of Public Economics*, **90**, 853-870, 2006.

Olken, B. A., "Corruption Perceptions vs. Corruption Reality," *Journal of Public Economics*, **98**, 7-8:950-964, 2009.

Pellegrini, L., and R. Gerlagh, "Corruption's Effect on Growth and its Transmission Channels," *Kyklos*, **57**, 3:429-456, 2004.

Philp, M., "Defining Political Corruption," *Political Studies*, **45**, 436-462, 1997.

Ray, D., *Development Economics*. Princeton, New Jersey: Princeton University Press, 1998.

Rock, M. T., and H. Bonnett, "The Comparative Politics of Corruption: Accounting for the East Asian Paradox in Empirical Studies of Corruption, Growth and Investment," *World Development*, **32**, 6:999-1017, 2004.

Rose-Ackerman, S., *Corruption: A Study in Political Economy*. New York: Academic Press, 1978.

Razafindrakoto, M., and F. Routboud, "Are International Databases on Corruption Reliable? A Comparison of Expert Opinion Surveys and Household Surveys in Sub-Saharan Africa," *Document de travail DT/2006-17*. DIAL, Paris School of Economics, 2006.

Shleifer, A., and W. Vishny, "Corruption," *Quarterly Journal of Economics*, **108**, 3:599-617, 1993.

Smarzynska, B., and S.-J. Wei, "Corruption and Composition of Foreign Direct Investment: Firm Level Evidence," *National Bureau of Economic Research, NBER Working Paper*, **7969**, 2000.

Soares, R. R., "Development, Crime, and Punishment: Accounting for the International Differences in Crime Rates," *Journal of Development Economics*, **73**, 155-184, 2004.

Stock, J. H., and M. Yogo, "Testing for Weak Instruments in Linear IV Regression," Unpublished manuscript, Harvard University, 2001.

Svensson, J., "Eight Questions about Corruption," *Journal of Economic Perspectives*, **19**, 19-42, 2005.

Tanzi, V., and H. Davoodi, "Corruption, Public Investment, and Growth," *International Monetary Fund Working Paper,* **WP/97/139**, 1997.

Tanzi, V., and H. Davoodi, "Corruption, Public Investment, and Growth," in G. T. Abed and S. Gupta, eds., *Governance, Corruption, & Economic Performance*. Washington, DC: International Monetary Fund, Publication Services, 280-299, 2002a.

Tanzi, V., and H. Davoodi, "Corruption, Growth, and Public Finances," in G.T. Abed and S. Gupta, eds., *Governance, Corruption, & Economic Performance*. Washington, DC: International Monetary Fund, Publication Services, 197-222, 2002b.

Transparency International, *Corruption in South Asia*. 2002. Available at http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan019883.pdf.

Transparency International India, *India Corruption Study 2005*.

Transparency International India, *India Corruption Study 2008 with Focus on BPL Households*, 2008.

Veermani, C., and B. Goldar, "Manufacturing Productivity in Indian States: Does Investment Climate Matter?" *Economic and Political Weekly*, June 11, 2413-2420, 2005.

Wei, S.-J., "How Taxing is Corruption on International Investors?" *Review of Economics and Statistics*, **82**, 1:1-11, 2000.

Welsch, H., "Corruption, Growth, and the Environment: A Cross-Country Analysis," *Environment and Development Economics*, **9**, 5:663-693, 2004.

World Bank, *Doing Business 2008*. Oxford University Press, 2008.

Wyatt, G., "Corruption, Productivity and Transition," *CERT Discussion Papers*, **205**. Centre for Economic Reform and Transformation, Heriot Watt University, 2002.

Appendix: Data sources and construction of variables

***Gross value added per worker**:* First, we obtain real gross value added by dividing the gross value added of each three-digit manufacturing sector in each year and state, available in the *Annual Survey of Industries*, by the deflator for the value of gross output at the two-digit industry level. We then divide the real gross value added by the number of workers in the three-digit manufacturing sectors.

***Capital-labor ratio**:* Capital stock is obtained by dividing fixed capital in the *Annual Survey of Industries* by the implicit capital deflator used in the *National Accounts Statistics*, published by the Central Statistical Office, Ministry of Statistics and Programme Implementation, Government of India. Then, we divide the capital stock by the number of workers in the three-digit manufacturing sectors.

TFP: The TFP index is obtained by the method described in the main body.

***Corruption**:* The data on corruption in each state is derived from *Crime in India*, published annually by the Ministry of Home Affairs, Government of India. The number of registered cases of corruption-related cases corresponds to "cases registered during that year" in the table for "statement of cognizable crimes registered & their disposal by anti-corruption and vigilance departments of states & UTs under the Prevention of Corruption Act and related sections of IPC during (that year)." We obtain the variable *corruption* by the method described in 2-4.

***Conviction rate**:* To obtain the conviction rate, we divide "cases convicted" by "total cases for investigation" in *Crime in India* mentioned above.

***Electricity**:* Electricity sales (million KwH) to ultimate consumers are obtained from the CMIE publication, *Infrastructure*. This number is divided by the thousand population.

Road: Data on total road length is available from *Basic Road Statistics of India*, Ministry of Shipping, Road Transport & Highways, Government of India. This number is divided by the thousand population.

***School enrolment rates**:* Both primary school and secondary school enrolment rates are available from *Selected Educational Statistics*, Ministry of Human Resource Development, Government of India. We use the enrolment ratio for classes I-V as primary school data.

***Disputes per worker**:* Statewise numbers of industrial disputes are derived from the *Indian Labour Yearbook*, annually published by the Labour Bureau, Ministry of Labour, Government of India.

***Bank branches**:* The data on the number of branches of scheduled commercial banks is obtained from *Statistical Tables Relating to Banks in India*, published by the Reserve Bank of India. The number of offices is divided by the thousand population.