The Journal of Development Studies, 2016
Vol. 52, No. 10, 1499–1516, http://dx.doi.org/10.1080/00220388.2016.1146702

Routledge
Taylor & Francis Group

Bureaucratic Corruption and Income: Evidence from the Land Sector in Bangladesh

ASADUL ISLAM* & WANG-SHENG LEE**,†
*Department of Economics, Monash University, Melbourne, Australia, **Department of Economics, Deakin University, Burwood, Australia, †Institute for the Study of Labor (IZA), Bonn, Germany

(Final version received December 2015; final version accepted December 2015)

ABSTRACT *We examine, for the first time, the effects of corruption on income using household survey data from a developing country. Estimating the effects of corruption on income is challenging because of the simultaneous relationship between the two variables. We use a two-step instrumental variable approach to identify the effects of corruption on income. We find that after adjusting for simultaneity bias the act of bribery reduces income and that higher bribes have a negative effect on income. Taken together, our results provide a possible explanation why a vicious cycle between corruption and income inequality does not exist in the land sector in Bangladesh.*

1. Introduction

Corruption can occur at many different levels in a country and can cause waste and a misallocation of resources that results in inefficiency and inequality.[1] Although difficult to define precisely, broadly speaking, corruption refers to illegal, or unauthorised, acts on the part of public officials who abuse their positions of authority to make personal gains.[2] The fact that the most corrupt countries in the world also tend to have the highest incidence of poverty and inequality is unlikely to be due to chance. Many developing countries appear to be trapped in a vicious cycle of widespread poverty, income inequality, and misgovernance. This is suggested by the casual observation that many of the poorest and most corrupt countries of the past are among the poorest and most corrupt countries today (for example, Bardhan, 1997). According to Uslaner (2008), people caught in these 'cultures of corruption' or 'inequality traps' make payments even though they are not happy about it because there is no way out (p. 10).

The empirical evidence supporting a positive relationship between corruption and income inequality is well documented (for example, Andres & Ramlogan-Dobson, 2011; Foellmi & Oechslin, 2007; Gupta, Davoodi, & Alonso-Terme, 2002; You & Khagram, 2005). Much of this research is based on subjective indices on corruption such as the International Country Risk Guide (ICRG) or the Corruption Perceptions Index (CPI). These studies rely on the cross-national variation in corruption and income inequality, in which the latter is typically measured with the Gini coefficient. In a review of the literature on corruption in developing countries, Olken and Pande (2012) voice doubts about the reliability of making inferences regarding corruption based solely on such aggregate perception indices. Several researchers found, based on micro-level data, that perceived corruption as measured

Correspondence Address: Wang-Sheng Lee, Department of Economics, Monash University, Caulfield East, Victoria 3145, Australia. Email: asadul.islam@monash.edu
An Online Appendix is available for this article which can be accessed via the online version of this journal available at http://dx.doi.org/10.1080/00220388.2016.1146702

by such indices is not correlated highly with citizens' actual experiences with corruption (for example, Olken & Barron, 2009; Razafindrakoto & Roubaud, 2010). One possible reason for the divergence might be that corruption perception indices measure some overall notion of corruption that includes all three types, whereas micro-level measures tend to be concerned with bureaucratic corruption specifically. As an alternative to aggregate corruption indices, Olken and Pande (2012) emphasise that the use of surveys of bribe-payers to measure bribery is a more direct approach. A number of recent studies used high-quality survey data at the individual, household, or firm level (see, for example, Choe, Dzhumashev, Islam, & Khan, 2013; Emran, Islam, & Shilpi, 2013; Hunt, 2008, 2010; Hunt & Laszlo, 2012; Mocan, 2008; Olken & Barron, 2009; Sulemana, 2015; Svensson, 2003).[3] These studies generally focused on the effects of income on the incidence of bribery or the amount paid in bribes. However, policy makers are potentially more interested in understanding the burden of corruption or how corruption affects the distribution of income.

This paper contributes to the literature by examining the effects of bureaucratic corruption on income. To the best of our knowledge, this is the first paper to use micro-level household survey data to examine empirically the link between corruption and income inequality. Estimating the effect of corruption on income is challenging because of the simultaneity between corruption and income. Empirical estimation requires that a suitable instrument for corruption be found – a variable that is highly correlated with corruption but that does not directly influence income. The availability of a large household-level dataset and local area rainfall data, which provides an exogenous variation of income, provides us with a method of dealing with the endogeneity problem. Our identification strategy for estimating the causal effect of corruption on income is to use a two-step instrumental variable (IV) approach. In the first step, we estimate the causal effect of income on corruption, in which we instrument for income. In the second step, based on a zero covariance restriction (Brückner, 2013; Hausman & Taylor, 1983), we use the residual variation in corruption that is not driven by income as an instrument to estimate the effect that corruption has on income. This two-step strategy provides a better understanding of how income and corruption are related at the micro level. Our main contribution to the literature lies in the second step, in which we provide estimates of the effect of corruption on income.

To better appreciate the link between income and corruption, we use corruption in transactions in the agricultural land sector in Bangladesh as our empirical focus in this paper. The main advantage of focusing on the land sector is that in a developing country such as Bangladesh, agriculture is the main source of livelihood for people who live in rural areas and exogenous variation in rainfall is a major determinant of crop production levels. We use local area rainfall variation, which largely determines the crop production of rural households in Bangladesh.

There are many other reasons that studying the effects of corruption in the land sector in a developing country such as Bangladesh is important. First, according to the Global Corruption Barometer 2013 (TI, 2013), around the world, one in five people report that they had paid a bribe for bureaucratic procedures related to land transactions. Corruption in the land sector is particularly critical in post-conflict societies and countries in transition, in which land records are not digitalised, where transparent and efficient land management is necessary to rebuild and reconstruct the country. Although land is a common source of corruption and conflict among households in many developing countries, the sector has surprisingly received no attention in the corruption literature.[4] Second, land markets play a particularly important role in determining the ability of households to generate subsistence as well as determining the distribution of income in developing countries. Insecure property rights and land corruption discourage long-term investment and hamper land productivity. For example, Banerjee, Gertler, and Ghatak (2002) find increased farm productivity due to agricultural tenancy laws that offer security of tenure to tenants in West Bengal, India. Besley and Burgess (2000) find poverty decreased due to land reform across Indian states. Third, the rural economy in developing countries that relies exclusively on land is the most important driver for stimulating income growth and thus a potential pathway out of poverty for the rural poor. Land markets play an important role in facilitating this transition.

Previewing our main findings, our 'local effects' stand in contrast with the general findings from the macro literature on corruption and income inequality. In particular, we find that higher levels of corruption are not associated with higher levels of income inequality. This is because we find that the rich are more likely than the poor to pay bribes and because paying larger bribes has a negative effect on income. In other words, the rich are actually worse off (in terms of income) by engaging in corruption.

2. Background: Land and Corruption

Land ownership plays a significant role in the lives of rural people in South Asia. In Bangladesh, more than 160 million people live in a total land area of 144,000 square km. About 70 per cent of the population lives in rural areas, and agricultural land makes up 70 per cent of the total land area. In 2012, 23.5 per cent of the country's gross domestic product (GDP) came from the agricultural sector, which accounted for 62 per cent of employment in the country, emphasising the important role of agriculture in the economy.

Corruption in the land sector is pervasive in South Asia. According to a survey conducted by Transparency International in Bangladesh in 2005 (TI, 2005a), 97 per cent of households that bought land had to pay bribes for land registration, 85 per cent had to pay bribes for changes in ownership and land-related documents, 83 per cent paid bribes for land surveys, and 40 per cent of households who received land had to pay bribes. A similar survey conducted in India also in 2005 (TI, 2005b) showed that about 79 per cent of those interacting with the Land Administration Department in India encountered corruption. Of those who paid bribes, more than 36 per cent had paid money to department officials, whereas 33 per cent had paid money to intermediaries such as document writers and property dealers to get the necessary documents. A household survey in Nepal (TI, 2003) concluded that the respondents perceived land administration was the most corrupt sector in the country.

Land is the major source of wealth and livelihood in rural Bangladesh. Often, demarcating land boundaries is a major source of conflict. Due to population growth and climate change, many rules, processes, and institutions that determine the allocation of scarce land resources have been put under considerable strain. People also need to pay for property registration, change or forge titles, acquire land information, process cadastral surveys, and generate favourable land use plans. The numerous administrative processes in a typical land transaction in Bangladesh increase the likelihood that one encounters a corrupt official.

Income plays a major role in the land markets in rural Bangladesh because of the large transaction costs in the sector. The high prevalence of bribery in the land sector creates a substantial cost for farmers trying to register or transfer land. Bribery can make land administration services inaccessible if people are not able to afford these illegal payments. Sarap (1995) provides evidence from India that despite a preference for land-holding on the part of farm households, many households have had to sell land involuntarily in order to mobilise funds for consumption, bribes, repayment of debts, or payment for medical services. He found that of a sample of land transactions conducted from 1950 to 1993 more than 50 per cent were distress sales since they occurred in the nine specific years during or preceding drought years. In many developing countries, insecure property rights, poor contract enforcement, and stringent legal restrictions limit the performance of land markets. As noted by Deininger and Feder (2001), the importance of being able to transfer use or ownership rights to land increases with economic development.

Disputes relating to the registration of land titles in Bangladesh fall within the jurisdiction of the Ministry of Land. In 2006 alone, bribes worth about 83 billion Taka (US$1.25 billion) were paid for land-related services such as registration and record changes (Transparency International (TI), 2005a). Processing a land transaction in Bangladesh is an extremely long and bureaucratic process. According to a 2010 report by the World Bank and the International Finance Corporation, registering a property in Bangladesh requires eight procedures, takes 245 days, and costs 10.24 per cent of the property's

value. In comparison, it takes five days to register a property in Nepal, 44 days in India, and 50 days in Pakistan. Given the absence of a transparent system, bribery and other irregularities are common. People in the administrative department who are responsible for creating and maintaining land records often prepare incorrect records intentionally, and land owners are forced to pay bribes to officials to get the records approved.

2.1 A Conceptual Framework: The Simultaneity between Corruption and Income

In this section, we describe a conceptual framework based on an 'all-pay auction' model to help explain why a simultaneous relationship between corruption and income can arise. Such a framework is widely used in economics to model political lobbying, rent seeking in regulated industries, and technological competition and R&D races (Baye, Kovenock, & De Vries, 1996). In an all-pay auction, each player submits a bid (a bribe in our context) and the player with the highest bid wins the contest. However, independent of success, all players bear the cost of their bids. Consider a sequential game with two types of agents: citizens and bureaucrats. Suppose that there are two citizens and one bureaucrat. Both the citizens want rights to a piece of land that is worth V dollars in the current period. The rights are given to the citizen that spends the highest on bribes. In the event of a tie in bribe amounts offered, the official will randomly award the rights to one of the citizens.

Let $B1$ and $B2$ denote the amount of bribes offered by citizens 1 and 2 respectively. The payoffs to citizen 1 are:

$$\pi = \begin{cases} V - B1 & \text{if } B1 > B2 \\ \frac{V}{2} - B1 & \text{if } B1 = B2 \\ -B1 & \text{if } B1 < B2 \end{cases}$$

The payoff to citizen 2 is similar to citizen 1. While the payoff to the citizens will depend on the bribery strategies they undertake, the payoff to the official is $B1 + B2$ and is unambiguously positive.

In this bribery game, the optimal bribe B^* for each citizen under a mixed strategy equilibrium is B^*/V, where B^* takes on a value between 0 and V with equal probability. In equilibrium, the expected payoff is zero for citizens 1 and 2. Citizen 2 uses the randomisation device to make sure that citizen 1 will always receive a zero payoff in equilibrium and vice versa.[5] It is a standard result that there is no equilibrium in pure strategies in all-pay auctions (Baye et al., 1996).

Why is the mixed strategy B^*/V an equilibrium? If citizen 1 bribes $B^* = B$ where $B < V$, then citizen 2 can bid $B + \varepsilon$ to win the rights to the land. In that case, citizen 1 should have placed a bid of $B + 2\varepsilon$ instead. Therefore, this does not constitute an equilibrium. Both citizens choosing to bribe V is not an equilibrium as the payoff equals 0.5 V – V which is negative and they would have been better off not bribing in the first place. In addition, both citizens would also never bid more than V as they will receive negative payoffs in all scenarios. Therefore, no pure strategy equilibrium exists.

Going back to the context of the land sector in Bangladesh, as land is a factor of production with value in future periods, V can be thought of as consisting of the present discounted value of a future income stream rather than a one-off payment. One case to consider is when the citizens have different valuations of V. Baye et al. (1996) show that when one 'strong' player competes against several weaker (but equal) players, in an equilibrium, the strong player earns a positive payoff while the weaker players have expected payoffs equal to zero.[6] Alternatively, V can be thought of as comprising a relatively large sum of money, and it is possible that a citizen participating in the bribery game has a budget constraint and will not be able to afford a strategy that requires paying bribes that span the range between 0 and V with equal probability. Under such a scenario, the citizen with the higher income or resources will win the bribery game most of the time. Kotowski and Li (2014) show that when there are private budget constraints in all-pay auctions, more aggressive bidding from players with relatively large budgets and valuations occurs as the marginal return of a higher bribe has increased.

In both these scenarios above, it is no longer that only the corrupt official gets a positive payoff and the citizens get a zero payoff in equilibrium. When there are heterogeneous valuations of the good or when there are private budget constraints, it is possible that both the corrupt official and the citizen with more resources will end up with positive payoffs. The framework of the all-pay auction model therefore highlights how income can be associated with being able to make higher bribe amounts, and how bribes can be positively correlated with income.

Kameir and Kursany (1985) describe how corruption helps to build up a chain of a small number of financiers who control most of the agricultural produce in Sudan. The economic intuition outlined here is a possible mechanism for why they describe corruption as 'a mode of income generation for the parasitic section of the Sudanese capitalist class' (p. 28). According to a recent report by Transparency International Bangladesh (TI, 2015), bribery rates related to the leases of hat-bazars (markets) range from 10,000 to 2,000,000 takas. The bribery rates related to hat-bazars are by far the highest amongst bribes paid for various land services.[7] The report states that a huge amount of hat-bazar land has been grabbed by some influential people with the connivance of land officials and local government bodies. This link between bribery and income generating activities is consistent with our argument that bribes can be positively correlated with income.[8]

The Transparency International (TI) (2015) report also highlights that there are numerous cases of land disputes occurring, where currently, land is the source of 60 per cent legal disputes in the country and the number of backlog cases for land disputes stands at 1.8 million (Transparency International (TI), 2015, p. 24). The high percentage of people paying bribes in the land sector suggests that there are many participants who participate in the bribery game, although there can only be one winner. The competitive nature of the bribery game in the land sector suggests there are likely many citizens who engage in bribery but who do not reap the benefits from bribery. However, it is less clear if a parasitic section of the capitalist class will dominate the bribery game in the land sector. In other words, it remains an empirical question what the association between bribery and income for households in Bangladesh will be.

3. Data and Summary Statistics

The information on corruption and socio-economic data come from national household surveys on corruption in Bangladesh conducted by Transparency International Bangladesh (TIB). The survey aims to capture people's experiences regarding corruption in selected public service sectors. This includes land administration and management, agriculture, law enforcement agencies, justices, education, health, local government and relief, power, water, and sanitation service, natural gas supply, tax, bank and financial institutes, insurance, non-government organisations, and other sectors. The sample module includes various locations such as rural areas, urban areas, and metropolitan centres.

The survey focuses on factual information provided by households on how they have experienced corruption while receiving a service during a given period and the service's nature, dimension, type, and implications. The survey measures actual corruption, is representative of the country's entire population, and primarily captures bribes paid during the course of daily life. The survey covers households' experiences with mostly bureaucratic corruption from July 2009 to June 2010. In the survey, corruption is defined as more than bribery: Corruption is the abuse of entrusted power for personal gain manifest in six common forms (bribery, negligence of duties, nepotism, embezzlement, deception, and extortion). We focus on corruption experienced with public officials involved in land administration. Each household was asked to report any corruption experienced during the course of obtaining land registration, land titles, land taxes, documents related to land, land surveys, and *khas* (state-owned) land management within the previous year. For each type of service, the survey asked if households had paid a bribe or encountered any corruption, the amount paid in bribes, and the role/title of the official involved in the transaction.

To select households for the survey, a three-stage stratified cluster sampling method was followed. The Integrated Multipurpose Sampling (IMPS) Frame developed by the Bangladesh Bureau of

Statistics was used as the sampling frame.[9] A total of 6000 households were interviewed, 3481 from rural areas and 2519 from urban areas. There were 300 Primary Sampling Units (PSUs): 174 for rural areas and 126 for urban areas. Then, 300 PSUs were distributed in 16 strata according to the national population weights of those strata. At the first stage, PSUs were selected randomly from each of the 16 strata. Then, a block of 20 households was constructed randomly from each PSU. Since some PSUs in the IMPS have fewer than 200 households, households from adjacent *Mauzas* (for example, village) were added to those PSUs. The PSUs covered all 64 districts in Bangladesh with divisional and rural–urban population representations.

The district level data were collected from the Bangladesh Bureau of Statistics. We obtained rainfall data for Bangladesh from Bandyopadhyay and Skoufias (2015). The original source of the rainfall data is the Climate Research Unit (CRU) of the University of East Anglia. Bandyopadhyay and Skoufias converted data from the CRU, which had come in the form of geographic coordinates, to *thana*- (sub-district) level rainfall by using weighted averages, where the weights are the proportion of the area of the *thana* in each 2.5° × 2.5° latitude-longitude grid.

In this paper, we consider only rural households that have land used to generate their livelihood. We exclude households from urban/metropolitan areas in the survey since very few households in urban areas have agricultural land.[10] Our final sample consists of 2223 rural households that had land one year before the survey.[11]

Table 1 presents the descriptive statistics on the basic socio-economic characteristics and outcomes for households in rural Bangladesh. On average, about 22 per cent of households in our sample paid a bribe for a land transaction. The average bribe amount paid within the previous year was 1087 Takas. Relative to an average annual total household expenditure of 9951 Takas and an average annual total

Table 1. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Income and Corruption					
Paid bribe in land	2223	0.22	0.41	0	1
Bribe amount in Takas	2223	1087.40	4934.83	0	100000
Bribe amount in Takas (conditional of making bribe)	490	4933.22	9573.18	10	100000
Household expenditure in Takas	2223	9951.39	7967.87	1850	161000
Household income in Takas	2223	13896.63	15772.04	1900	411000
Log bribe amount (conditional of making bribe)	490	7.47	1.57	2.30	11.51
Log household expenditure in Takas	2223	9.02	0.579	7.52	11.99
Log household income in Takas	2223	9.28	0.666	7.55	12.93
Demographic and Local Characteristics					
Household size	2223	5.82	2.35	2	21
Number of females	2223	2.76	1.41	0	11
Age of head (years)	2223	51.13	13.91	2	115
Sex of head (Male = 1)	2223	0.90	0.30	0	1
Head Muslim (Muslim = 1)	2223	0.85	0.36	0	1
Head's occupation (professional = 1)	2223	0.06	0.23	0	1
Head's education > year 12	2223	0.23	0.42	0	1
Total owned land (in decimals)	2223	245.88	271.51	50	2782
Network	2221	0.67	0.47	0	1
District population size (in 100,000s)	2159	21.50	14.80	2.93	85.76
District crop value (in 100,000,000s of Takas)	2159	31.22	16.76	2.86	70.76
Rainfall Variables					
Rain percentage change 2008–2009	2223	−17.85	6.55	−26.59	−6.47
Rain percentage change 2009–2010	2223	−17.94	19.61	−44.58	41.41
Heavy rain 2000–2009 (4^{th} quartile)	2223	0.23	0.42	0.00	1
Low rain 2000–2009 (1^{st} quartile)	2223	0.28	0.45	0.00	1
Rainfall levels 2009 (in mm)	2223	1446.27	400.00	961	2972
Rainfall levels 2010 (in mm)	2223	1192.29	489.32	508	2855

Notes: In 2010, one US$ was worth approximately 69 Takas.

Table 2. Burden of bribery for those who paid a bribe

	Average bribe amount in Takas	Ratio of bribe amount to household income
Household income		
Bottom quintile	2592.64	0.56
2nd quintile	2655.74	0.38
3rd quintile	5027.75	0.49
4th quintile	6365.94	0.44
Top quintile	6996.23	0.22

Note: Income quintiles are based on all rural households.

household income of 13,896 Takas, the bribe represents about 11 per cent of expenditure and about 8 per cent of household income. Household size in rural Bangladesh is generally large and comprises an average of 5.8 members. A small proportion of household heads work in professional occupations (about 6%), and a large percentage of households (about 47%) work in the agricultural sector. The average land owned by households is about 2.5 acres (246 decimals).

Studies in the literature that find that bribery is progressive or regressive generally rely on tabulations that show the variation in bribe outlays by income quintiles. Do richer households pay more in bribe payments in absolute terms as well as when expressed as a share of their total income? Table 2 shows that the average annual bribe payments are higher for richer households when households are ranked according to total household income. This data supports the notion that some form of price discrimination takes place in the land sector in Bangladesh on the part of corrupt officials, since they are able to extract more rent from richer households. Although the rich pay more in bribes, when bribe outlays are examined as a percentage of total household income, households in the top quintile pay less. For example, although households in the bottom quintile of household income pay an average of 56 per cent of their total income in bribes in the land sector, households in the top quintile pay an average of 22 per cent of their total income. This unconditional bivariate relationship suggests that there is a greater burden of corruption on the poor than on the rich in the land sector in Bangladesh.

4. Empirical Methods

4.1 The Effect of Income on Corruption

Identifying the effects of corruption on income first requires addressing the issue of reverse causality. We estimate the effect of income on corruption in land transactions by using the following equation:

$$Corruption_i = \beta_0 + \beta_1 Income_i + \beta_2 X_i + \beta_3 Land_i + \varepsilon_i \quad (1)$$

where corruption is measured either as the event of engaging in a bribe for a land-related transaction (measured as a binary variable) or the amount paid in the bribe (measured in Takas). The household income amount and the amount paid in bribes are expressed in logs.[12] Variables in the set of controls denoted by X include the number of family members, the number of females in the household, the age of the head of the household, whether or not the head of the household is a Muslim, the occupation of the household head (professional or not), and the education level of the household head (high school graduate or not). Since richer households are likely to engage in larger volumes of land transactions and are likely to have higher stakes, these households are likely to pay larger bribes because of the size of the households' land holdings. To address this concern, we control for the amount of land owned by households. Given the amount of time it takes to register a piece of land in Bangladesh, it will take time for the effects

of a bribe to fully materialise. Therefore, a contemporaneous relationship between bribery and land holdings, conditional on other controls, is unlikely. We also examine whether geographic characteristics matter, such that people living in some areas are more vulnerable to corruption because of factors such as population and soil fertility. We do so by controlling for population size and crop production at the district level (Bangladesh has 64 districts).

In general, much of the microeconomic evidence of how income affects bribery is based on ordinary least square (OLS) regressions. An exception includes Hunt and Laszlo (2012), who use information on living standards such as type of dwelling, type of telephone, type of sanitation facility, and type of household ownership as instruments for household expenditure to address the measurement error issue in income and expenditure. However, if unobservable factors are associated with income and corruption (for example, unscrupulous people are more likely to bribe and attain business success), then the coefficients and estimated marginal effects will be biased. In other words, if we estimate Equation (1) using OLS, the coefficient on income is a potentially biased measure of the effect of income on corruption, as there is the possibility of reverse causality: those who are corrupt might be rewarded and obtain higher levels of income for their corrupt practices. Proper identification of the effect of income requires an exogenous source of variation for income.

In estimating the effect of income on corruption, we use local geographic variations in rainfall in Bangladesh over the period 2000–2010 to help induce exogenous variation in income and expenditure that would arise through changes in agricultural productivity. Our identification strategy is similar to others in the economics literature who have used rainfall as an instrument for income in a country where agriculture is the dominant sector (for example, Emran et al., 2013; Jayachandran, 2006; Miguel, Satyanath, & Sergenti, 2004; Paxson, 1992; Voors, Bulte, & Damania, 2011).

For our IV estimates, we use local geographic (*thana*) level rainfall data for Bangladesh that were constructed by Bandyopadhyay and Skoufias (2015).[13] Table 1 provides descriptive statistics on the rainfall variables we use as instruments, as well as the averages and variations in rainfall levels in 2009 and 2010. We use two alternative measures of local rainfall variability to instrument for income in Equation (1). The first is the annual percentage change in rainfall for the two preceding years before the TIB 2010 household survey. In Bangladesh, income and consumption are highly dependent on the agricultural harvest. Much of the agricultural cultivation in South Asia depends on the monsoon rains, so that the pre-harvest lean season coincides with the late rainy season. Crop failure or a poor harvest can lead to seasonal hardships. Irregular occurrences, such as floods or failure of the monsoon rains, can magnify the adverse seasonal effects to an extent that leaves irreversible adverse effects on livelihood sustainability and can culminate in a famine-like situation (Khandker & Mahmud, 2012). Since the household survey was conducted in 2010, we take the percentage change in rainfall levels between 2008–2009 and 2009–2010 to proxy for the expected agricultural harvest in 2010. For example, for the change between 2008 and 2009, this is computed as the simple difference in rainfall levels between 2008 and 2009 divided by the rainfall levels in 2008. Using this measure of rainfall follows Miguel et al. (2004), who use current and lagged rainfall growth to instrument for per-capita economic growth.

The second rainfall measure captures positive and negative rainfall shocks. We first create a baseline rainfall measure for each area by taking area averages of the rainfall levels for 2000–2009.[14] We then define two binary variables. First, we designate villages as heavy rainfall areas if they have an average rainfall over the last 10 years that exceeds the 75th percentile of the average rainfall in the country. This binary variable can potentially help capture any negative shocks due to heavy rainfall. Since low levels of rainfall can also be problematic for crop production, we designate villages as low rainfall areas if they have an average rainfall over the last 10 years that is below the 25th percentile of average rainfall in the country. Using rainfall shocks in this fashion is consistent with previous studies that use rainfall as an instrument for crop yield and income (for example, Emran et al., 2013; Jayachandran, 2006).

4.2 Validity of Rainfall as an Instrument

The key identifying assumptions that underlie the validity of rainfall as an instrument are that heavy rainfall reduces income and rainfall does not work through other channels in influencing bribery in the land sector in rural areas of Bangladesh. The exclusion restriction has several potential objections, which we discuss in turn.

First, heavy rainfall could induce higher migration of male members in search of work. This will lead to a higher proportion of households headed by female members, which have lower bargaining power and which could be more likely to pay bribes. In the context of justifying the use of local-area rainfall as an instrument for the education sector in Bangladesh, Emran et al. (2013) find, using data from the 2010 Household Income and Expenditure survey in Bangladesh, that the proportion of female-headed households is not different in heavy and non-heavy rainfall areas. This suggests that male migration from heavy rainfall areas to urban areas is not likely to be an issue. Second, people in flood-prone areas might be less risk averse. Emran et al. (2013) explore this issue using the size of a household's precautionary grain stock. They show that grain stocks due to the precautionary motive are not different in heavy and non-heavy rainfall areas, suggesting no differences in the risk preferences across areas. Third, long-term rainfall differences across districts may have affected local institutions. For example, if heavy rainfall leads to flooding and subsequent flood relief activity, more corruption might be induced with such activity. As a result, heavy rainfall areas might be more likely to implement tougher laws against bribery. Since the legal and enforcement institutions are designed for the whole of Bangladesh and not at the district level, however, it is extremely unlikely that heavy rainfall areas have different enforcement mechanisms against corruption compared to non-heavy rainfall areas. To substantiate our claims, we check whether people are more likely to pay a bribe or have paid more money to the judiciary or faced extortion or harassment from law enforcement agencies for any services. The survey includes detailed information about receiving services from the police, the judiciary and other services such as local government, water and electricity supplies, education, and health services. We do not see any significant differences between high and low rainfall areas.

We also conduct two falsification checks. The first test is a similar analysis of households in large urban areas that do not depend on agriculture for their livelihood. Rainfall is less likely to affect the income of these households. The second test involves dividing all districts in Bangladesh into disaster-prone and non-disaster-prone areas based on historical information regarding the districts' susceptibility to flooding. Based on data on crop damage and loss of cultivable land due to floods at the sub-district level from 1981 to 2005, we identify a *district* as historically flood prone if more than 50 per cent of the crops were damaged in a district at least five times during this 25-year period.[15] Similar to the logic used in Sarsons (2012), in districts that are not prone to flooding, the correlation between heavy rainfall and bribery should disappear or be weakened.[16]

When we perform our IV analysis on urban areas (n = 460) instead of rural areas, as would be expected, we find that the instruments are weak. The corresponding first-stage F-statistics (based on model specifications we later use in Table 5) are 0.87, 1.87, 0.61, and 1.75, respectively. Similarly, when we perform the same regression for non-flood prone areas (n = 882), we find that the instruments are relatively weaker than in the flood-prone areas. The corresponding first-stage F-statistics for non-flood prone areas are 0.87, 0.76, 0.71, and 1.62, respectively. These results give us confidence that rainfall does not influence corruption through means other than income.

4.3 The Effect of Corruption on Income

We estimate the effect of corruption on income using the following equation:

$$Income_i = \gamma_0 + \gamma_1 Corruption_i + \gamma_2 X_i + \gamma_3 Land_i + \gamma_4 Z_i + u_i \quad (2)$$

where Z_i are the excluded instruments used in the two-stage least squares estimation of Equation (1). If we find that income has a significant effect on corruption in Equation (1), then the OLS estimation of the effect of corruption on income in Equation (2) will be biased because$\text{cov}(Corruption_i, u_i) \neq 0$.

In the simultaneous equation system involving Equations (1) and (2), Equation (1) is identified if $\gamma_4 \neq 0$ but Equation (2) is not identified unless we make further assumptions or impose additional restrictions. Since Equation (2) is of interest in our application to address the issue of how corruption affects income, we assume a zero covariance restriction in order to achieve identification. Identification of such models is discussed in Hausman and Taylor (1983) and Wooldridge (2010, section 9.4.2). Instead of finding an exogenous variable as an instrument for corruption, we create a measure of corruption that is adjusted for endogeneity and use this as an instrument for corruption.[17] This adjusted measure of corruption is obtained by partialling out the response of corruption to income:

$$\begin{aligned} Corruption^{*} &= Corruption - (\beta_1 Income_i + \beta_2 X_i + \beta_3 Land_i) \\ &= Corruption - \widehat{Corruption} \end{aligned} \tag{3}$$

where $\widehat{Corruption}$ is the predicted value of corruption from Equation (1). By construction, Equation (2), estimated using two-stage least squares using $Corruption^{*}$ as an instrument for corruption, does not suffer from simultaneity bias. The IV estimator provides a consistent estimate of γ_1, assuming that ε_i and u_i are uncorrelated. Since the estimation of the effect of corruption on income requires that a consistent estimate of the effect of income on corruption (β_1) is available as an input, the validity of the instrument and model specification in Equation (1) plays a key role in determining whether we correctly estimate the effect of corruption on income in Equation (2). As emphasised by Brückner (2013), although this approach solves the problem of simultaneity bias, there could still be omitted variable bias if Equation (1) or (2) is mis-specified (see Brückner (2013) for more details).

5. Results

For each bribery outcome, we estimate two models. In the first model, we control for key socio-demographic variables, including the total amount of land owned by the household. In the second more extended model, we also control for district-level differences in population size (with the bottom quartile as the omitted reference group) and the value of the crops produced.[18]

5.1 OLS Results

Table 3 presents the OLS estimates of Equation (1). The results in Table 3 suggest that income is significantly related to the propensity to pay a bribe at the 1 per cent level when district-level controls are included. Columns 3 and 4 suggest that, conditional on making a bribe, the rich are likely to pay a higher amount in bribe payments, as evident from the positive and significant coefficients of income. Thus, at the intensive margin, bribery is progressive. Comparing the results in columns (1) and (3) with the corresponding results in columns (2) and (4) respectively, we can see that adding the additional district-level variables does not significantly affect the size, or significance, of the coefficient on household income. The district-level controls, however, such as district population size, also affect corruption. Thus, while geographic characteristics do not influence our estimates of the effects of income on corruption, these characteristics affect the corruption experienced at the household level.

The estimated income elasticity of bribe amounts is about 0.37 to 0.39 based on the OLS model. This compares with income elasticities reported by Hunt (2010) and Hunt and Laszlo (2012) that are positive in the range of 0.15 to 0.66.

In Table 4, we examine the reverse effect: how bribery affects the long-term income of a household. The OLS results suggest that the incidence of making a bribe has a positive effect on household income when district-level controls are included. Higher bribe payments in turn are associated with

Table 3. OLS effects of household income on propensity to pay bribe/bribe amount

	(1) Pay Bribe	(2) Pay Bribe	(3) Log Bribe Amount	(4) Log Bribe Amount
Log household income	0.062***	0.069***	0.397***	0.373**
	(0.018)	(0.019)	(0.149)	(0.151)
Household size	−0.001	−0.003	−0.100*	−0.095*
	(0.007)	(0.007)	(0.053)	(0.054)
Number of females	0.001	0.003	0.102	0.077
	(0.010)	(0.010)	(0.084)	(0.086)
Age of head	−0.001*	−0.001*	−0.000	−0.002
	(0.001)	(0.001)	(0.006)	(0.006)
Sex of head	0.008	0.003	−0.376*	−0.373*
	(0.029)	(0.029)	(0.224)	(0.222)
Head Muslim	0.081***	0.085***	−0.084	−0.026
	(0.023)	(0.023)	(0.233)	(0.239)
Head's occupation	−0.016	−0.014	0.403	0.408
	(0.037)	(0.037)	(0.291)	(0.303)
Head's education > year 12	−0.018	−0.007	0.032	0.043
	(0.025)	(0.024)	(0.184)	(0.182)
Total owned land/1000	0.085**	0.089**	0.523**	0.490*
	(0.041)	(0.042)	(0.262)	(0.264)
District population quartile = 2		−0.037		0.299
		(0.040)		(0.193)
District population quartile = 3		−0.062*		0.007
		(0.037)		(0.259)
District population quartile = 4		−0.121**		0.173
		(0.047)		(0.315)
District crop value		0.003***		−0.010
		(0.001)		(0.007)
N	2223	2159	490	474
adj. R^2	0.031	0.037	0.067	0.067

Notes: All models include regional dummies. Standard errors in parentheses. Standard errors are clustered at the primary sampling unit level. *** p < 0.01, ** p < 0.05, * p < 0.1.

higher household income levels, suggesting that there is a positive return to paying larger bribes. Most of the other controls have the expected signs. In particular, we see that income increases with household size, education, and the amount of land owned. Muslim households also have higher incomes.

The OLS results are subject to bias and suffer from endogeneity and a reverse causality problem. However, they provide a useful benchmark for our analysis and demonstrate the relevance of addressing these issues in our context. Below, we present results using IV estimates following empirical strategies outlined in Sections 4.1 and 4.3 to estimate the effect of a household's economic status on corruption and the effect of corruption on household economic status.

5.2 IV Results

IV estimates of the effect of household income on the extensive and intensive margins of bribery are reported in Tables 5 and 6. The IV estimates in Table 5 are based on using annual percentage changes in rainfall as the instrument, which is our preferred instrument. Results based on the binary instrument denoting rainfall shocks are weaker based on the first-stage *F*-statistics (see Appendix Table A.1). The 2SLS results reported in Table 5 suggest that OLS estimates are biased downward. The IV estimates on the income variable for both outcomes – the incidence and amount of bribery – are larger.

Results presented in columns 1 and 2 of Table 5 show that income is not related to the probability of paying a bribe (that is, richer households are not more likely to pay a bribe). However, the IV estimates

Table 4. OLS effects of propensity to pay bribe/bribe amount on household income

	(1) Log Household Income	(2) Log Household Income	(3) Log Household Income	(4) Log Household Income
Pay bribe	0.101***	0.110***		
	(0.031)	(0.031)		
Log bribe amount			0.053***	0.050**
			(0.020)	(0.020)
Household size	0.093***	0.095***	0.106***	0.109***
	(0.009)	(0.009)	(0.018)	(0.019)
Number of females	−0.016	−0.019	−0.033	−0.036
	(0.013)	(0.013)	(0.030)	(0.031)
Age of head	0.001	0.000	−0.003*	−0.004**
	(0.001)	(0.001)	(0.002)	(0.002)
Sex of head	−0.102**	−0.088**	−0.112	−0.086
	(0.043)	(0.044)	(0.094)	(0.093)
Head Muslim	0.219***	0.209***	0.315***	0.289***
	(0.047)	(0.045)	(0.083)	(0.085)
Head's occupation	0.354***	0.351***	0.434***	0.433***
	(0.046)	(0.046)	(0.107)	(0.112)
Head's education > year 12	0.454***	0.442***	0.412***	0.406***
	(0.035)	(0.034)	(0.064)	(0.063)
Total owned land/1000	0.547***	0.554***	0.445***	0.450***
	(0.061)	(0.064)	(0.112)	(0.116)
District population quartile = 2		0.100*		0.152
		(0.059)		(0.102)
District population quartile = 3		0.210***		0.213**
		(0.062)		(0.104)
District population quartile = 4		0.241***		0.198
		(0.087)		(0.162)
District crop value		−0.004*		−0.003
		(0.002)		(0.004)
N	2223	2159	490	474
adj. R^2	0.383	0.401	0.407	0.407

Notes: All models include regional dummies. Standard errors in parentheses. Standard errors are clustered at the primary sampling unit level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 5. IV estimates of effects of household income on propensity to pay bribe/bribe amount

	(1) Pay Bribe	(2) Pay Bribe	(3) Log Bribe Amount	(4) Log Bribe Amount
Log household income	0.103	0.200	1.750***	1.657**
	(0.104)	(0.128)	(0.609)	(0.720)
Household characteristics	Yes	Yes	Yes	Yes
District variables	No	Yes	No	Yes
N	2223	2159	490	474
First-stage F-statistic	16.87	11.91	8.75	6.85

Notes: All models include regional dummies. Standard errors in parentheses. Standard errors are clustered at the primary sampling unit level. *** p < 0.01, ** p < 0.05, * p < 0.1. Instrument for household income: rain percentage change 2008–2009, rain percentage change 2009–2010.

on the effect of income on bribe amounts (columns 3 and 4, Table 5) suggest that conditional on paying a bribe, an increase in income is associated with an increase in bribe payments. Comparing the OLS and IV results, we find that the IV estimates are about four times the magnitude of the OLS coefficients. The estimated income elasticity from the IV model is now about 1.7, whereas it was only between 0.37 and 0.39 based on the OLS model (see Table 3).

Table 6. IV estimates of effects of propensity to pay bribe/bribe amount on household income

	(1) Log Household Income	(2) Log Household Income	(3) Log Household Income	(4) Log Household Income
Pay bribe	−0.069**	−0.214***		
	(0.028)	(0.030)		
Log bribe amount			−0.200***	−0.186***
			(0.027)	(0.027)
Household characteristics	Yes	Yes	Yes	Yes
District variables	No	Yes	No	Yes
N	2223	2159	490	474
First-stage F-statistic	119539	30595.7	781.78	843.38

Notes: All models include regional dummies. Standard errors in parentheses. Standard errors are clustered at the primary sampling unit level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Instrument for propensity to pay bribe/bribe amount: residuals from corresponding columns in Table 5.

Table 6 presents results that estimate the effects of bribery on income based on using the constructed instrument given in Equation (3). The results are very different from those based on OLS estimates. In particular, the signs are the opposite of the corresponding OLS results presented in Table 4. The 2SLS estimates suggest that the act of paying a bribe has a significant negative effect on household income (columns 1 and 2). Larger bribe payments also lead to lower household income, implying that the return to paying larger bribes is actually negative and that richer households do not benefit from paying larger bribes. The IV results in Table 6 imply that by choosing to pay a bribe, household income is expected to decrease by between 7 per cent and 21 per cent instead of increasing by between 10 per cent and 11 per cent as suggested by the OLS results. Conditional on paying a bribe, the IV results in Table 6 also suggest that doubling the bribe amount (that is, increasing it by 100 per cent) will decrease household income by about 19–20 percentage points. In other words, the OLS results give very different and misleading implications compared to the IV results.

Since the effect of income on corruption is influenced by how much land one owns (for example, richer households are more likely to be involved in larger land transactions than poor households or have more land to protect from primitive accumulation) and because larger bribes might need to be paid for larger plots of land, we also tried including an interaction term between income and total amount of land owned in Equation (1) and an interaction term between bribery and total amount of land owned in Equation (2). In line with our IV strategy, we use the interaction between rainfall and total amount of land as the instrument for the interaction term in Equation (1) and the interaction between the relevant residual (given by Equation (3)) and total amount of land as the instrument for the interaction term in Equation (2). Results corresponding to Tables 5 and 6 are presented in Tables A.2 and A.3 in the Appendix. Although the interaction terms are insignificant in Table A.2, the interaction between bribe amount and total land owned is significant in Table A.3, suggesting that the more land one owns, the more positive the effect of the bribe amount on income will be. This implies that paying larger bribes when one owns more land has some positive returns.

5.3 Do Social Networks Influence Our Results?

In Equation (1), higher income can play a dual role. On the one hand, higher income represents the household's ability to pay. However, higher income is also an indicator of a household's bargaining power that captures, among other things, social and political connections. Families with access to informal networks (for example, some connection with a political leader, elected local government representative, or other influential person) might have more clout compared those who do not have social connections. For example, richer households might be able to avoid paying bribes and bypass

Table 7. Robustness check of estimated IV effects including the network variable

	(1) Pay Bribe	(2) Log Bribe Amount	(3) Log Household Income	(4) Log Household Income
Log household income	0.208	2.038**		
	(0.148)	(0.958)		
Pay bribe			−0.223***	
			(0.030)	
Log bribe amount				−0.231***
				(0.029)
Network	−0.017	−0.629*	0.226***	0.231***
	(0.041)	(0.351)	(0.028)	(0.071)
Household characteristics	Yes	Yes	Yes	Yes
District variables	Yes	Yes	Yes	Yes
N	2157	474	2157	474
First-stage F-statistic	10.04	4.78	28496.8	570.12

Notes: All models include regional dummies. Standard errors in parentheses. Standard errors are clustered at the primary sampling unit level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Instrument for household income: rain percentage change 2008–2009, rain percentage change 2009–2010. Instrument for propensity to pay bribe/bribe amount: residuals from columns 1 and 2, respectively.

corrupt officials because of who the households happen to know. If richer households also happen to have better networks, then income might simply be acting as a proxy measure for bargaining power. In the survey, households were asked whether they were involved with a political party, were a member of a social/cultural organiSation, whether they have a household member living in the capital city, Dhaka, whether they listen to news on the radio or TV, or read newspapers regularly. We construct an index of social network in which we assign a value of one if there was a positive response to any of these questions and a value of zero otherwise. The mean value of the network variable is 0.67, with a standard deviation of 0.47. By including networks as an extra covariate in Equation (1), we hope to obtain a 'purged' effect of income on bribery. These results are presented in Table 7. The new IV results correspond to the results in Tables 5 and 6 with the district controls included. In Table 7, the coefficients are not very different in magnitude from those in Table 5. The corresponding estimates of the reverse effects of bribery on income are also similar to the corresponding results found in Table 6. Therefore, these results increase our confidence that the relationships we found between income and bribery in Tables 5 and 6 are robust.

Since the network variable is potentially endogenous, we do not focus on its coefficient. We are mainly interested in whether our coefficients of income and corruption in the IV estimates are affected by the inclusion of such a network variable. Choe et al. (2013) focus on examining the effects on networks on corruption in the education sector in Bangladesh. However, finding a credible instrument that could be an exogenous source of networks and that does not affect either income or corruption is very difficult.

6. Discussion

Based on three agriculture and livestock censuses conducted over the past three decades in rural Bangladesh, Rahman and Rahman (2009) discuss interesting dynamics that have been taking place in the land sector. Unlike the experience in East Asian countries such as Japan and Korea, where farm sizes are increasing at the same time that the total number of farms is decreasing, Bangladesh is experiencing a rapid decline in farm sizes coupled with an increase in the number of operational holdings.

An insight into the factors that may be preventing land purchases leading to the concentration of land in the hands of richer and potentially more productive farmers is provided by Ullah's (1996) study of land transfers in Bangladesh. Looking at data in two villages from 1972 to 1986, he finds that the aggregate distribution of land remains remarkably stable over time in both villages, despite important differences in the villages' internal dynamics. Why has an asset-owning and productive capitalist class that hires workers to work on the farms not been created in Bangladesh? Why has there been a repeated churning of small parcels of land and no capitalist farmers capturing more land over time? In a country where a significant share of the total land belongs to an economically struggling and low-productivity peasantry, the emergence of a bigger capitalist sector should theoretically involve non-market dispossessions of some very poor peasants.

Khan (2004) suggests that this is not due to a badly working administrative structure and instability of land rights in Bangladesh. Far from opposing the instability of land rights, local landed elites try their best to exploit this instability for their own benefit, and often push and corrupt the bureaucracy, the police, and the courts in ways that further increase instability. At the village level, virtually all rich peasants of any standing are allied with one or another local political faction, and they are engaged intensely with the local bureaucracy and the police to further their strategies of accumulating land holdings. Any observer of these processes must conclude that landed classes are just as much responsible for the corruption and arbitrary interventions of bureaucrats and courts as they are victims of these forces. Yet few rich farmers grow beyond a certain point because competitors are continuously and successfully challenging their growth. According to Khan (2004), the competition and balance of power between factions also means that those who are attacked today have a good chance of reclaiming or resisting these encroachments tomorrow. The cyclical success or failure of individual factions depends on an ongoing and chaotic political re-alignment of the mosaic of primary factions, each driven by calculations of how bargaining power can be maximised. The policy implication of Khan's (2004) analysis, if he is correct, is that no amount of loans from agencies such as the World Bank to carry out institutional reforms to improve the land record systems, or to improve the quality of district-level courts, is likely to have any discernible effect on reforming Bangladesh's land sector.

In this paper, our analysis provides an alternative possibility. Our explanation of the observed farm size dynamics in Bangladesh involves the simultaneity between corruption and income. Using a two-step IV approach, we identify the effects of corruption in the land sector on income once the effects of income on corruption are accounted for. The IV estimates suggest that conditional on paying a bribe, an increase in income is associated with an increase in bribe payments. Conversely, we find that the act of bribery reduces income and that higher amounts paid in a bribe have a negative effect on income.

Taken together, our results provide a plausible explanation why a vicious cycle between corruption and income does not exist in the land sector in Bangladesh. Substantial resources might be simply expended on protecting and retaining property rights. Since the rich are more likely than the poor to pay larger bribes, and because paying larger bribes has a negative effect on income, the rich are actually worse off (in terms of income) by engaging in corruption. In other words, the rich do not experience any immediate payoffs for corruption in the land sector. Thus, corruption in land transactions appears to effectively serve as a tax on the income of the rich and helps restrain their ability to acquire more land. This is consistent with the observed dynamics of farm sizes in rural Bangladesh where a larger capitalist agricultural sector has not emerged.

7. Conclusion

In this paper, we examine the simultaneous relationship between bureaucratic corruption and income in the land sector in Bangladesh using an instrumental variable approach. The land sector is closely connected with the livelihoods and economic activities for a large fraction of the rural population in Bangladesh. Yet, despite government efforts to streamline land administration, bribery, corruption and usurpation of state and private properties are commonplace. Bribery can be an integral part of an asset accumulation strategy, in which the goal is to acquire income and wealth through land acquisition. It is

also possible that wealthier individuals will be more likely to engage in bribery because they have the means to do so or because of higher valuation of their time and demand for services. For example, to get ahead in a processing queue for land transactions, wealthier individuals might pay a bribe to help speed up the processing of their applications. However, we find no evidence supporting these viewpoints.

In this paper, we took a bottom-up approach based on micro-level data. This contrasts with the empirical literature on corruption and inequality, which is typically based on cross-country data. Although our results suggest that land corruption does not appear to worsen income inequality in Bangladesh in the short run, this is no evidence that bribery has no adverse economic effects in all sectors of the economy or in the longer run.

Acknowledgement

We thank Zakir Khan, Iftekhrauzzaman, and Transparency International Bangladesh for access to the household-level corruption survey data and Sushenjit Bandyopadhyay and Emmanuel Skoufias for the local rainfall data on Bangladesh used in this paper. We thank two anonymous referees, Lutfunnahar Begum, Chongwoo Choe, Chris Doucouliagos, Shahe Emran, Pedro Gomis-Porqueras, and Russell Smyth for helpful comments and suggestions. Chau Nguyen provided excellent research assistance. All errors are our own.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. An alternative and more positive viewpoint of corruption is that it can 'grease the wheels' of an economy, in which bureaucrats accept bribes in return for by-passing cumbersome regulations that work against efficiency. However, Ades and Di Tella (1999) argue that corruption can more appropriately be described as 'sand in the machine' as they did not find benefits associated with corruption.
2. Jain (2001) distinguishes between three main types of corruption that can occur in a society: grand corruption, bureaucratic or petty corruption, and legislative or political corruption. Grand corruption is corruption that affects the government on a large scale. Bureaucratic or petty corruption refers to everyday abuse of entrusted power by low- and mid-level public officials in their interactions with ordinary citizens, who often are trying to access basic goods or services in places such as hospitals, schools, police departments, and other agencies. Finally, legislative or political corruption refers to corruption so prevalent that it is part of the everyday structure of society.
3. Svensson (2003) finds that firms with more ability pay larger bribes. Olken and Barron (2009) report that drivers with observable characteristics that indicate a higher willingness to pay, such as those driving newer trucks or carrying valuable cargo, are charged higher prices by corrupt officials. Hunt (2008) finds that bribery is regressive in dealings with the police in Peru but progressive in dealings with the judiciary. Mocan (2008) finds that richer households are more likely to face a demand for bribe in developing countries but not so in developed countries. Hunt (2010) argues that richer clients are more likely to bribe a public official, due to a higher valuation of their time and demand for services. Hunt and Laszlo (2012) find that the rich bribe more frequently than the poor, but that the poor pay more in bribes as a share of their income. Choe et al. (2013) and Emran et al. (2013) find that rich people pay smaller bribes in the education sector in Bangladesh. Sulemana (2015) includes both corruption perception and experiences in an empirical model exploring the correlates of subjective well-being.
4. Studies that have used household survey data on corruption have previously focused on other sectors such as education (Choe et al., 2013; Emran et al., 2013), health (Hunt, 2010), and the police and the judiciary (Hunt, 2008). Glaeser, Scheinkman, and Shleifer (2003) examined the effects of unequal distribution of economic and political resources on the workings of the legal system.
5. This result can also be generalised to the case where there are n citizens but we will focus on the case $n = 2$ for exposition and economic intuition.
6. See their Theorem 2.
7. Hat-Bazars are the indigenous markets that work under the supervision of local government and owned by the local government in Bangladesh. These markets play a vital economic role in the rural areas of Bangladesh.

8. See Table 1 in the TI (2015) report.
9. The IMPS design consists of 1000 *Mauzas* distributed in 16 strata according to rural, municipality, and Statistical Metropolitan Areas (SMA) throughout the country. There were six rural, six urban, and four SMA strata. These *Mauzas* constitute the primary sampling units in this sampling frame.
10. We use the sample from urban/metropolitan areas to check the validity of our instruments.
11. The survey includes the total land a household owns including homestead land. We restrict our analysis to households that own at least 50 decimals of land since the very poor do not have the means to buy land. This cut-off has been used in the economics literature to identify the asset poor (for example, Davis & Baulch, 2011).
12. As the income and bribery amount variables tend to be highly skewed, we follow the convention in the literature and use the log of each measure in our models.
13. Bandyopadhyay and Skoufias (2015) show that a large variation in the rainfall exists among different *thanas* in Bangladesh. Bangladesh, at present, has about 500 administrative *thanas* in rural and urban areas.
14. This assumes that the average level of rainfall over the period 2000–2009 is a good indication of conditions that are ideal for the agricultural sector. The average for 2000–2009 is not very different from the average values constructed over alternative longer periods of time such as 1950–2009.
15. The data are compiled by Iqbal and Roy (2014) from different sources of the Bangladesh Bureau of Statistics (BBS): (i) Yearbook of Agricultural Statistics, BBS, ii) Agriculture Census Report, BBS, and iii) Thana Statistics and Upazila Statistics, BBS. The number of times crops and crop areas were damaged has been determined based on the flood data. According to this criterion, about 55 per cent of 64 districts are categorised as flood prone.
16. Sarson's (2011) analysis is based on the fact that there are numerous dams in India that help insulate nearby downstream districts from adverse weather conditions such as droughts.
17. This approach was adopted from a widely cited study by Blanchard and Perotti (2002) in the context of identifying the effects of government spending and taxes on GDP. Brückner (2013) is a more recent application in the context of how foreign aid affects economic growth.
18. We do not use district fixed effects, since rainfall and corruption data are available only at the district level in many cases. Thus, using district fixed effects would remove the possibility of using variation in rainfall as an instrument.

References

Ades, A., & Di Tella, R. (1999). Rents, competition, and corruption. *American Economic Review*, *89*(4), 982–993. doi:10.1257/aer.89.4.982

Andres, A., & Ramlogan-Dobson, C. (2011). Is corruption really bad for inequality? Evidence from Latin America. *Journal of Development Studies*, *47*(7), 959–976. doi:10.1080/00220388.2010.509784

Bandyopadhyay, S., & Skoufias, E. (2015). Rainfall variability, occupational choice, and welfare in rural Bangladesh. *Review of Economics of the Household*, *13*(3), 589–634. doi:10.1007/s11150-013-9203-z

Banerjee, A., Gertler, P., & Ghatak, M. (2002). Empowerment and efficiency: Tenancy reform in West Bengal. *Journal of Political Economy*, *110*(2), 239–280. doi:10.1086/338744

Bardhan, P. (1997). Corruption and development: A review of issues. *Journal of Economic Literature*, *35*(3), 1320–1346.

Baye, M., Kovenock, D., & De Vries, C. (1996). The all-pay auction with complete information. *Economic Theory*, *8*(2), 291–305. doi:10.1007/BF01211819

Besley, T., & Burgess, R. (2000). Land reform, poverty reduction, and growth: Evidence from India. *The Quarterly Journal of Economics*, *115*(2), 389–430. doi:10.1162/003355300554809

Blanchard, O., & Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *The Quarterly Journal of Economics*, *117*(4), 1329–1368. doi:10.1162/003355302320935043

Brückner, M. (2013). On the simultaneity problem in the aid and growth debate. *Journal of Applied Econometrics*, *28*(1), 126–150. doi:10.1002/jae.1259

Choe, C., Dzhumashev, R., Islam, A., & Khan, Z. (2013). The effect of informal networks on corruption in education: Evidence from the household survey data in Bangladesh. *Journal of Development Studies*, *49*(2), 238–250. doi:10.1080/00220388.2012.709620

Davis, P., & Baulch, B. (2011). Parallel realities: Exploring poverty dynamics using mixed methods in rural Bangladesh. *Journal of Development Studies*, *47*(1), 118–142. doi:10.1080/00220388.2010.492860

Deininger, K., & Feder, G. (2001). Land institutions and land markets. In B. Gardner & G. Rausser (Eds.), *Handbook of agricultural economics* (Vol. *1*, 1st ed., pp. 287–331)). Amsterdam: Elsevier.

Emran, M., Islam, A., & Shilpi, F. (2013). *Admission is free only if your dad is rich! Distributional effects of corruption in schools in developing countries* (World Bank Policy Research Working Paper 6671). Washington, DC: World Bank.

Foellmi, R., & Oechslin, M. (2007). Who gains from non-collusive corruption? *Journal of Development Economics*, *82*(1), 95–119. doi:10.1016/j.jdeveco.2005.10.002

Glaeser, E., Scheinkman, J., & Shleifer, A. (2003). The injustice of inequality. *Journal of Monetary Economics*, *50*(1), 199–222. doi:10.1016/S0304-3932(02)00204-0

Gupta, S., Davoodi, H., & Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? *Economics of Governance*, *3*(1), 23–45. doi:10.1007/s101010100039

Hausman, J. A., & Taylor, W. E. (1983). Identification in linear simultaneous equations models with covariance restrictions: An instrumental variables interpretation. *Econometrica*, *51*(5), 1527–1549. doi:10.2307/1912288

Hunt, J. (2008). *The contrasting distributional effects of police and judicial bribery* (Working Paper). Montreal: McGill University.

Hunt, J. (2010). Bribery in health care in Uganda. *Journal of Health Economics*, *29*(5), 699–707. doi:10.1016/j.jhealeco.2010.06.004

Hunt, J., & Laszlo, S. (2012). Is bribery really regressive? Bribery's costs, benefits, and mechanisms. *World Development*, *40*(2), 355–372. doi:10.1016/j.worlddev.2011.06.001

Iqbal, K., & Roy, P. (2014). *Examining the impact of climate change on migration through the agricultural channel: Evidence from district level panel data from Bangladesh* (Working Paper No. 84-14). Kathmandu: South Asian Network for Development and Environmental Economics (SANDEE).

Jain, A. K. (2001). Corruption: A review. *Journal of Economic Surveys*, *15*(1), 71–121. doi:10.1111/1467-6419.00133

Jayachandran, S. (2006). Selling labor low: Wage responses to productivity shocks in developing countries. *Journal of Political Economy*, *114*(3), 538–575. doi:10.1086/503579

Kameir, E., & Kursany, I. (1985). *Corruption as the "fifth" factor of production in the Sudan* (Research Report No. 72). Uppsala: Scandinavian Institute of African Studies.

Khan, M. H. (2004). Power, property rights and the issue of land reform: A general case illustrated with reference to Bangladesh. *Journal of Agrarian Change*, *4*(1–2), 73–106. doi:10.1111/j.1471-0366.2004.00073.x

Khandker, S. R., & Mahmud, W. (2012). *Seasonal hunger and public policies evidence from northwest Bangladesh*. Washington, DC: World Bank.

Kotowski, M. H., & Li, F. (2014). On the continuous equilibria of affiliated-value, all-pay auctions with private budget constraints. *Games and Economic Behavior*, *85*, 84–108. doi:10.1016/j.geb.2014.01.014

Miguel, E., Satyanath, S., & Sergenti, E. (2004). Economic shocks and civil conflict: An instrumental variables approach. *Journal of Political Economy*, *112*(4), 725–753. doi:10.1086/421174

Mocan, N. (2008). What determines corruption? International evidence from microdata. *Economic Inquiry*, *46*(4), 493–510. doi:10.1111/j.1465-7295.2007.00107.x

Olken, B. A., & Barron, P. (2009). The simple economics of extortion: Evidence from trucking in Aceh. *Journal of Political Economy*, *117*(3), 417–452. doi:10.1086/599707

Olken, B. A., & Pande, R. (2012). Corruption in developing countries. *Annual Review of Economics*, *4*, 479–509. doi:10.1146/annurev-economics-080511-110917

Paxson, C. H. (1992). Using weather variability to estimate the response of savings to transitory income in Thailand. *American Economic Review*, *82*(1), 15–33.

Rahman, S., & Rahman, M. (2009). Impact of land fragmentation and resource ownership on productivity and efficiency: The case of rice producers in Bangladesh. *Land Use Policy*, *26*(1), 95–103. doi:10.1016/j.landusepol.2008.01.003

Razafindrakoto, M., & Roubaud, F. (2010). Are international databases on corruption reliable? A comparison of expert opinion surveys and household surveys in Sub-Saharan Africa. *World Development*, *38*(8), 1057–1069. doi:10.1016/j.worlddev.2010.02.004

Sarap, K. (1995). Land sale transactions in an Indian village: Theories and evidence. *Indian Economic Review*, *30*(2), 223–240.

Sarsons, H. (2012). *Rainfall, rupees and riots: Testing rainfall as an instrumental variable* (Working paper). Vancouver: University of British Columbia.

Sulemana, I. (2015). An empirical investigation of the relationship between social capital and subjective well-being in Ghana. *Journal of Happiness Studies*, *16*(5), 1299–1321. doi:10.1007/s10902-014-9565-9

Svensson, J. (2003). Who must pay bribes and how much? Evidence from a cross section of firms. *The Quarterly Journal of Economics*, *118*(1), 207–230. doi:10.1162/00335530360535180

Transparency International (TI). (2003). *Household survey Nepal*. Kathmandu: Transparency International.

Transparency International (TI). (2005a, April). *Household survey Bangladesh*. Dhaka: Transparency International Bangladesh.

Transparency International (TI). (2005b, August). *India corruption study 2005*. New Delhi: Transparency International India.

Transparency International (TI). (2013). *The global corruption barometer 2013*. Berlin: Transparency International.

Transparency International (TI). (2015). *Land management and services in Bangladesh: Governance challenges and way-forward*. Dhaka: Transparency International Bangladesh.

Ullah, M. (1996). *Land, livelihood and change in rural Bangladesh*. Dhaka: University Press Ltd.

Uslaner, E. M. (2008). *Corruption, inequality, and the rule of law: The bulging pocket makes the easy life*. Cambridge, UK: Cambridge University Press.

Voors, M. J., Bulte, E. H., & Damania, R. (2011). Income shocks and corruption in Africa: Does a virtuous cycle exist? *Journal of African Economies*, *20*(3), 395–418. doi:10.1093/jae/ejr011

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). Cambridge, MA: MIT Press.

You, J.-S., & Khagram, S. (2005). A comparative study of inequality and corruption. *American Sociological Review*, *70*(1), 136–157. doi:10.1177/000312240507000107