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Economic Freedom and Corruption: New Cross-Country Panel Data Evidence

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Abstract
This paper examines the empirical relationship between economic freedom and corruption. We use a principal-agent-client model to identify the potential causal linkages between corruption and the components of economic freedom. We then estimate a two-equation system where freedom depends on corruption and vice versa. Using a series of panel GMM estimators, we find that corruption lowers economic freedom, but that freedom does not significantly impact corruption. The result that corruption lowers freedom supports the "grabbing hand" theory of corruption, where a nonbenevolent government creates inefficient regulation and barriers to entry to generate economic rents.

JEL Codes: D73, K40, O17, P50
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I. Introduction

A growing literature examines the empirical relationship between economic freedom and corruption. The first and more prominent branch of this literature looks at the role played by economic freedom in explaining cross-country differences in corruption. By estimating determinants of economic freedom, Goldsmith (1999), Chafuen and Guzmán (2000), Paldam (2002), and Shen and Williamson (2005) find that economic freedom is negatively related to corruption. Subsequent analysis shows that this negative relationship does not hold across all components of freedom (Goel and Nelson 2005); levels of income (Graeff and Mehlkop 2003);

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levels of corruption (Billger and Goel 2009); and the inclusion of fixed country effects (Saha, Gounder, and Su 2009).

The second branch investigates the impact of corruption on economic freedom outcomes. There are two papers of note: Emerson (2006) and Apergis, Dincer, and Payne (2012).[1] Emerson develops a theoretical agency model that relates corruption to competition. He then estimates the determinants of competition and of corruption and finds a negative relationship between the two variables. Using education and democracy to instrument for corruption, he finds that greater corruption lowers competition. Emerson does not examine the effect of freedom on corruption due to his research question. Apergis, Dincer, and Payne use a panel error correction approach to examine the linkages between corruption, freedom, and other macroeconomic outcomes across US states. Their causality tests find that economic freedom causes less corruption and also that corruption causes less freedom. However, these state-level results may have limited applicability to countries due to their significantly wider range of corruption and freedom outcomes.

In this paper, we examine the impact of economic freedom on corruption and freedom on corruption. We use the principal-agent-client (PAC) model of Aidt (2003) to identify potential causal linkages between corruption and the components of economic freedom. In our example, the regulator (principal) allocates entry licenses to firms (agents) following a process set by the client (government). If the government is assumed to be benevolent, then the "helping hand" of government sets the regulatory process, including the number of licenses, to maximize social welfare. In this case, economic freedom causes corruption. If, however the government is assumed to be nonbenevolent, then the grabbing hand of government intervenes to create economic rents. In this case, corruption causes economic freedom.

We then estimate a two-equation system to test these linkages. We use a series of panel general method of moment (GMM) estimators where identification is achieved through the use of external (or excluded) and internal (lagged values) instruments. Our GMM results find that corruption lowers economic freedom, but that

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[1] Although these two papers are the only two to our knowledge that look at the impact of corruption on economic freedom, there are several papers that examine the determinants of economic freedom: La Porta et al. (2002), Crampton (2002); De Haan and Sturm (2003); Powell and Ryan (2006); Campbell and Snyder (2012); Heckelman and Wilson (2015); and March, Lyford, and Powell (2015).

freedom does not significantly impact corruption. With regard to the components of freedom, we find that rule of law, open markets, and regulatory efficiency lower corruption, while limited government raises it.

Our paper contributes to the literature on economic freedom and corruption in several important ways. First, we expand the sample coverage to over 160 countries compared to the typical sample of 50–100 countries or 50 US states. By including a much wider distribution of corruption and freedom outcomes, we limit potential sample selectivity bias and increase the power of our results. Second, we control for unobserved heterogeneity through the inclusion of regional or country effects. Potential unmeasured correlates are likely to occur between freedom and corruption given measurement error. Third, we identify causality between freedom and corruption using external and internal instruments. In particular, we use democracy, education, and resource rents interacted with democracy to instrument for corruption and geographical measures to instrument for economic freedom. Fourth, we examine the impact of corruption on the different components of economic freedom and each component's influence on corruption.

The rest of the paper proceeds as follows. In section 2, we use the PAC model to generate the helping hand and grabbing hand theories of corruption. We present our econometric methodology, including our identification strategy, in section 3. We describe the data in section 4 and present our empirical results in section 5. We conclude with some policy implications in section 6.

II. Corruption and Economic Freedom

Corruption is the use of public office for private gains (Rose-Ackerman 1999; Treisman 2000). Given its clandestine nature, corruption cannot be directly observable, so it must be inferred through other means, such as surveys on corruption or by estimating a structural model (Dreher, Kotsogiannis, and McCorriston 2007). Economic freedom, on the other hand, is defined as the ability of individuals to work, produce, consume, and invest in any they please, and that freedom is both protected by the state and unconstrained by the state (Beach and Miles 2006). Economic freedom involves multiple rights and liberties that are quantified through different regulatory (and economic) policies.

A. Theoretical Model

We use the basic principal-agent-client (PAC) model of Aidt (2003) to identify potential linkages between corruption and economic freedom. In PAC models, the principal (government) sets the rules governing the regulatory relationship between the regulator (regulator) and the clients (private agents) (Klitgaard 1998 and Lambsdorff 2002). We focus in our example on the licensing of firms into a market with potential safety concerns, such as the markets for food or pharmaceuticals.

The government sets the licensing rules, including the total number of (one unit) licenses λ. The r regulators implement these rules by choosing which firms receive a license and which firms do not. Each regulator earns a government wage of w and foregoes a wage of $w_0 \geq 0$ in the private sector. To introduce heterogeneity, a fraction (γ) of all regulators are assumed to be honest, while the remainder ($1 - \gamma$) are dishonest. The honest regulators choose those firms to license on the basis of some observable safety criteria, while the dishonest regulators will choose the less-safe firm by falsification if the bribe raises those regulators' expected private returns (Becker 1968).

For exposition purposes, we list the parameters of the model in table 1. We link each regulatory parameter to a corresponding component of economic freedom and then to a predicted impact on corruption. The number of licenses λ records competition and thus corresponds positively to the *Open Markets* component. The fraction of honest regulators γ and the private wage rate w capture business and labor freedoms contained in the *Regulatory Efficiency* component. The government wage rate w and the number of regulators r relate negatively to *Limited Government*, since the size of government, measured by either revenue or expenditure, is positively related to government employment and government wages (Kraay and Van Rijckeghem 1995).

Depending upon the motives of government, the PAC model can be solved for the two main theories of corruption (Aidt 2003, 2016). The helping hand theory of corruption assumes that the government is benevolent in that it chooses a licensing process to maximize social welfare. With potential negative externalities in the marketplace, government selects a number of licenses, λ_{bg}, lower than the quantity obtained under free competition, λ_{fc}. As a result, a firm with a license will earn a positive economic profit: $\pi(\lambda_{bg}) > 0$.

Table 1. Correspondence between Theoretical Parameters and Predictions and Economic Freedom Components

Model parameter	Symbol	Corresponding component of freedom	Sign of correspondence	Predicted relation to corruption
Number of one unit licenses	λ	Open markets	+	+
Honest regulators (%)	γ	Reg. efficiency (business freedom)	+	+
Private wage rate	w	Reg. efficiency (labor freedom)	+	+
Government wage rate	w_0	Limited government	–	–
Number of regulators	r	Limited government	–	+
Probability of corruption detection	p	Rule of law (property rights)	+	+
Firm penalty for corruption	g	Rule of law (property rights)	+	+
Regulatory penalty for corruption	f	Rule of law (property rights)	+	+

Note: The model parameter and symbol refer to the theoretical parameter in section 2. The corresponding component is that component of economic freedom that matches to the model parameter and the sign of the correspondence is the sign of the relationship. The predicted relation to corruption is the sign of the relationship between the model parameter and corruption in section 2.

The government (principal) delegates the licensing of firms to the regulators (agent) due to expertise or private information. These regulators are either honest or dishonest. Although the government cannot observe the motives of the regulators, it does possess a monitoring device like auditing that discovers a falsified application with probability p. Discovery of corruption results in the regulator being dismissed and paying a fine of f and the firm paying a penalty of g. These three parameters (p,f,g) correspond to the *Rule of Law* component.

A firm has an incentive to offer a bribe, b, to a dishonest regulator in exchange for a license. This licensed firm gains π if not caught, but pays g if caught, for an expected return of $\pi(\lambda_{bg}) - p \cdot g$. Assuming for simplicity that the regulator has all bargaining power, the equilibrium bribe b^* is $\max\{\pi(\lambda_{bg}) - p \cdot g, 0\}$. This equilibrium bribe b^* will be negatively related to the number of licenses λ_{bg} since entry into the licensed market reduces economic profits.

A dishonest regulator earns a government wage w plus the bribe b if not caught and earns a private sector wage w_0 but pays f if caught. The expected return is $(1-p)(w+b)+p(w_0-f)$. A dishonest regulator will only accept a bribe if the expected return exceeds the guaranteed government wage w from honest reporting. Therefore, bribing will occur if, and only if

$$(1-p)b+p(w_0-w-f) \;>\; 0 \quad (1)$$

where $b^* = \pi(\lambda_{bg})$ and $\pi'(\lambda_{bg}) < 0$. Assuming that $(w+b)>w_0$, bribery and thus the incidence of corruption are a negative function of the government wage w, the penalty f, and the number of licenses λ_{bg}; and a positive function of the private sector wage w_0. The level of corruption also depends positively on the number of regulators r and the fraction of dishonest regulators $(1-\gamma)$.

The important takeaway for our purposes is that the regulatory parameters determine the *actual* level of corruption under the helping hand theory. Each of these parameters corresponds to a component of economic freedom. With a benevolent government, increases in *Open Markets*, *Regulatory Efficiency*, and *Rule of Law* will decrease corruption. However, the impact of *Limited Government* on corruption is unknown, since lower government wages increase corruption but a decrease in the number of regulators decreases corruption.

The grabbing hand theory of corruption assumes that the government is nonbenevolent. With government agents pursuing their own interests, a second principal-agent problem emerges where the populace (principal) cannot fully monitor the government (agent) or hold it accountable. As a result, the government introduces inefficient policies and market restrictions to secure private rents (Shleifer and Vishny 1993 and Rose-Ackerman 1999).

In our example, a self-interested government agent is free to choose the number of licenses λ and their recipients. The economic profit generated from a license depends negatively on the number of licenses: $\pi = \pi(\lambda)$ where $\pi'(\lambda) < 0$. A government agent maximizes her bribe revenues, $B(\lambda) = \lambda \cdot b$, where $b = \pi(\lambda)$ due to complete bargaining power. Given that the profitability of each license is inversely related to the total number, the agent chooses $\lambda_{nbg} = \pi(\lambda) \;/\; \pi'(\lambda)$. This equilibrium quantity λ_{nbg} is always less than the total under free entry λ_{fe} and is likely less than λ_{bg} under a benevolent government.[2]

The licenses have value to the holder only if entry is restricted below the free-entry outcome. The corruptible government agent therefore has an incentive to create market barriers and other restrictions (Bliss and Di Tella 1997; Emerson 2006). As a result, corruption leads to less *Open Markets*, lower *Regulatory Efficiency*, and less *Rule of Law*. The impact of corruption on *Limited Government* is likely negative since the government will want to expand to create more rent opportunities (Scully 1991; Goel and Nelson 1998). Yet many of the least corrupt nations in Europe have the largest governments (La Porta et al. 1999).

The model's purpose is to show that corruption can cause economic freedom and vice versa, rather than to produce a testable implication between unobserved government motives and corruption. Under helping hand corruption, a benevolent government chooses regulatory policies that serve as constraints to the corruption opportunities of the dishonest regulators. As a result, more economic freedom, except limited government, leads to less corruption. Under grabbing hand corruption, a nonbenevolent government uses regulatory policy to create economic rents for himself. In this case, a more corrupt government leads to less economic freedom.

III. Methodology

Our theoretical model predicts that corruption (*CORR*) and economic freedom (*FREE*) are determined simultaneously depending on the type of corruption:

$$CORR_{it} = \alpha_i + \beta_F FREE_{it} + \beta' X_{it} + \gamma' Z_{it} + \lambda_t + \varepsilon_{it} \quad (2)$$

$$FREE_{it} = \alpha_i + \theta_C CORR_{it} + \theta' X_{it} + \delta' G_{it} + \lambda_t + v_{it} \quad (3)$$

where α_i is a set of country effects; (β_F, θ_C) are the coefficients of interest; $(\beta, \gamma, \theta, \delta)$ are vectors of the other coefficients; λ_t is a set of time dummies; and $(\varepsilon_{it}, v_{it})$ are the i.i.d. error terms. There are

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[2] In a Cournot model, it is well-known that total profits are inversely related to the number of firms and are maximized at the monopoly level of output. Therefore, it is likely that a self-interested government will restrict the number of licenses to maximize bribe amounts. A formal proof that $\lambda_{nbg} < \lambda_{bg}$ is beyond the scope of this paper since it requires a functional form for the (1) demand curve, (2) cost of production, (3) negative externality, and (4) utility function of representative voter.

three types of control variables. The X variables are those controls that directly influence both corruption and economic freedom. The Z variables are those specific to the determination of corruption but independent of freedom (i.e. $E[Z_{it}v_{it}]=0$). The G variables are those linked to economic freedom outcomes but independent of the corruption decision (i.e. $E[G_{it}\varepsilon_{it}]=0$).

We select a parsimonious set of variables for X that are common to both the determination of corruption and economic freedom.[3] These variables are:

- *GDP per Capita* is real gross domestic product per person using purchasing power parity (PPP) adjustments. Richer countries have stronger preferences for better and more visible government and also more resources to monitor corruption and improve regulation. As such, we expect a positive impact of GDP per capita on both corruption and economic freedom.
- *FDI* is inward foreign direct investment as a percentage of GDP. Countries with higher inward *FDI* are likely to be more open to international goods, financial markets, and scrutiny. As a result, there may be less opportunity for corruption and more possibility of economic freedom.
- *Political Stability* records perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism (Kaufmann and Kraay 2015). Greater political instability and violence shorten the incumbent's effective time horizon, which can lead to more corrupt behavior along the lines of Olson's (1993) "roving bandit." Similarly, the shortened time horizon increases the returns to policy intervention and thus reduces freedom.

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[3] We start with a pool of about twenty variables found to be robustly linked to corruption (Serra 2006; Seldadyo and de Haan 2006) and/or economic freedom (March, Lyford, and Powell 2015). We then use Bayesian Averaging of Classical Estimates (BACE) of Sala-i-Martin, Doppelhofer, and Miller (2004), which constructs estimates as a weighted average of OLS estimates for every possible combination of included variables, to identify our set of variables robustly related to both corruption and freedom.

- *Former British Colony* is a dummy variable indicating if a country is a former British colony. Former British colonies inherited a common law tradition where laws are made by judges based on precedent and a legal culture that emphasized procedural justice over substantive issues (Treisman 2000). As a result, Treisman (2000) and Serra (2006) find that former British colony status is robustly linked to corruption even when separate legal status controls are included.
- *Protestantism* is the percentage of population that is Protestant in 1980. Treisman (2000) argues that "the religious traditions of Protestant institutions of the church . . . may play a role in monitoring and denouncing abuses by state officials" (p. 403) and adds that the separation of church and state found especially in Protestantism leads to a civil society that more effectively monitors the state.

The choice of Z and G is more difficult since each variable is assumed to be a determinant for one variable of interest and independent of the other variable of interest. Our Z instruments must influence the corruption decision but not directly impact economic freedom. Two potential instruments are citizen oversight and expected gains from allocating natural resources. Emerson (2006) argues that citizen oversight (monitoring by the voting public) is likely to focus on corruption given its economic and moral losses and less so on economic freedom given its complex transfer of welfare from consumers to producers. As such, citizen oversight proxies such as democracy and education should serve as good instruments for corruption. We use the sum of civil liberties and political rights to measure *Democracy* and the average years of schooling in the twenty-five and up population to measure *Education*.

Another possible instrument is the potential gains to officials who allocate rights for natural resources (Ades and Di Tella 1999). A resource boom raises the economic returns of resource extraction and the incentive to bribe to acquire resource rights. At the same time, a resource boom can lower economic freedom (Campbell and Snyder 2012; March, Lyford, and Powell 2017). However, as argued earlier, monitoring by citizens is likely to focus on corruption such as the illegal allocation of natural resources and less on freedom. In addition, political competition forces a self-interested incumbent government to consider the public welfare in general and nonresource industries in particular (Bulte and Damania 2008). As a result, democracy can constrain an incumbent government's ability to extract resource rents. We therefore use the interaction of *Resource Rents* (relative to GDP) and *Democracy* as an additional instrument for corruption.[4]

Our *G* instruments must impact economic freedom but not spill over into the corruption decision. A country's geographical characteristics can affect its ability to trade internally and externally (cf. Frankel and Romer 1999; Frankel and Rose 2002). In particular, more remote countries will have less-established international trade networks and thus possess less-open markets. Similarly, countries with larger surface areas are more likely to experience fragmented internal markets and thus have less-open markets. At the same time, the corruption decision is determined by the potential benefits and costs of corrupt acts, which are likely to be independent of geographic factors. In fact, past empirical research finds that geography can have little to no direct impact on factor accumulation (Frankel and Romer 1999), foreign aid (Tavares 2003), and corruption (Bonaglia, Braga de Macedo, and Bussolo 2001).

Consistent estimation of equations (2) and (3) requires that the independent variables *X*, *FREE*, or *CORR* be independent of the error term in each equation. Correlation can occur if there is unobserved heterogeneity across countries or simultaneity in corruption and freedom. To address unobserved heterogeneity, we use pooled OLS with regional dummies, fixed effects (FE), and random effects (RE). The FE estimator assumes that the individual country effects are fixed and potentially correlated with the observed regressors, while RE assumes that the individual country effects are random variables distributed independently of the regressors. A Hausman (1978) test is used to test the consistency of RE. For each estimator, we adjust our standard errors to cross-country heteroskedasticity using the so-called cluster-robust covariance matrix of White (1980).

To address endogeneity, we use a series of optimal (two-step) generalized method of moments (GMM) estimators. GMM

[4] The corruption and resource curse literatures typically measure resource abundance using raw materials exports as a percent of total exports (cf. Treisman 2000) or mineral production as a percent of GDP (cf. Papyrakis and Gerlagh 2004). The natural resources rent measure, introduced in 2011, has the advantage of recording potential gains from bribery more directly and of providing more extensive country coverage.

estimation uses all empirical moments including those in IV to estimate the parameters of their theoretical counterpart. These moment conditions are functions of the model parameters and the data, such that their expectation is zero at the true values of the parameters. The optimal GMM provides efficiency gains if the errors are heteroskedastic and/or autocorrelated, which is likely in our panel of countries (Maddala 1999). In addition, multiequation GMM of an overidentified system can generate further efficiency by allowing both cross-equation correlation and heteroscedasticity (Hayashi 2000, chap. 4).

The first GMM estimator used is the single-equation IV-GMM of Baum, Schaffer, and Stillman (2003). IV-GMM uses the exogeneity of the instruments as the moment conditions to build the GMM objective function. The resulting GMM estimator in matrix form is

$$\hat{\beta} = (Z'ZWZ'X)^{-1} Z'ZWZ'y \quad (4)$$

where X are the explanatory variables, Z are the instruments, y is the dependent variable, and W is the weighting matrix. The optimal GMM estimator uses a two-step procedure to choose the optimal weighting matrix $\hat{W}$ in (4).

The second GMM estimator is "3SLS-GMM" of Wooldridge (2010, chap. 8). The three-stage least-squares (3SLS) estimator jointly estimates all parameters of a system of equations. One of the defining characteristics of the traditional 3SLS is that the errors are homoskedastic conditional on the instrumental variables. The 3SLS-GMM extends the traditional 3SLS by allowing for heteroskedasticity and different instruments for different equations. The homoskedasticity assumption is lifted by considering different weighting matrices.

The third GMM estimator is the system GMM of Arellano and Bover (1995) and Blundell and Bond (1998). The system-GMM estimator combines a set of first-difference equations with a levels equation to estimate (2) and (3) individually. The lagged levels of the endogenous variables are then used as instruments in the first-difference equations and lagged first-differences are used as instruments in the levels equation. The system-GMM has much smaller bias and greater precision relative to the difference GMM of Arellano and Bond (1991) when the dependent variable is persistent. Another advantage is that internal instruments can be used for identification of the endogenous variable.

IV. Data

We compile a dataset of 164 countries. The data, which span from 1995 through 2012, possess extensive cross-sectional information yet limited time variation. Moreover, many of the data are updated irregularly and thus do not vary from year to year. We therefore use data for each fifth year—1995, 2000, 2005, 2010—where the average value of the prior, current, and post years (i.e., 1999–2001 for 2000) is used for each data point.[5] Although there may be potential efficiency gains in using annual data, these gains are more than offset by a larger measurement error that would occur with fixed effects and first differences using annual data.[6]

The variables of interest are economic freedom and corruption. There are two main indices of economic freedom: the Heritage Foundation's Index of Economic Freedom and the Fraser Institute's Economic Freedom of the World Index. We use the Index of Economic Freedom due to greater country coverage and a more consistent aggregation procedure (Heckelman and Stroup 2005). The Index of Economic Freedom is based on ten quantitative and qualitative factors, grouped into four broad categories: rule of law, limited government, regulatory efficiency, and open markets. We remove the corruption subcomponent from rule of law to prevent a circular relationship. There are two corruption perception measurements: World Bank's Governance Indicators Control of Corruption indicator and Transparency International's Corruption Perception Index. We use the Control of Corruption indicator due to more sources and weighing them using an unobserved component (or factor) model in an attempt to reduce statistical uncertainty (Rohwer 2009). We also use a corruption experience measure from the World Business Environment Survey (WBES) due to potential selection bias in the perception measures (Donchev and Ujhelyi 2014; Standaert 2015).[7]

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[5] Graeff and Mehlkop (2003) use the same three-year averaging technique in their cross-sectional analysis of the determinants of corruption.

[6] Griliches and Hausman (1986) show that under standard assumptions, first differencing data with measurement error makes the bias worse. However, taking longer differences of the data such as time t to time t–2 or t–3 will reduce this measurement error. Moreover, the use of a three-year averaging technique approximates the instrumental variable estimator recommended by Griliches and Hausman of using lagged values to instrument for the current value.

[7] The World Business Environment Survey (WBES) is a survey of over 10,000 firms in eighty countries and one territory conducted from 1999 to the present. We use the response to the statement, "It Is Common for Firms in My Line of

Table 2 provides the summary statistics and data sources of our dataset. We convert the Index of Economic Freedom to a 0 to 6 scale. The two corruption measures are inverted and rescaled so that the lowest possible value (0) corresponds to the least-corrupt nation and the highest possible value (6) corresponds to the most-corrupt country. The three variables of interest have similar means (3.0 to 3.5) with corruption possessing more variability than freedom.

Table 2. Summary Statistics

Variable	Mean	Std. dev.	Source
Econ Freedom	3.0740	0.5048	Heritage Foundation
Corruption	3.5052	1.0242	Worldwide Governance Indicators
*WBES Corruption Experience**	3.3275	1.0901	World Business Enterprise Survey
ln*(GDP per capita*)	7.9839	1.6427	World Development Indicators
FDI (*% of GDP*)	4.2241	5.5405	World Development Indicators
Pol Stability	–0.1114	0.9219	Worldwide Governance Indicators
Former British Colony	0.3045	0.4606	La Porta et al. (1999)
Protestantism (*% of pop*)	12.1521	20.4305	La Porta et al. (1999)
*Education**	7.2290	3.0175	Barro-Lee Educational Attainment Dataset
Democracy	4.6283	1.8896	Freedom House's Freedom in the World
*Resource Rents**	6.9724	20.4084	World Development Indicators
Resource Rents x *Democracy**	21.1122	36.6575	Computed using above
ln(*area*)	12.0225	2.0472	CIA Factbook
ln(*remoteness*)	–8.8707	0.2499	Computed using CEPII GeoDist Dataset

Note: The data set is an unbalanced panel of 164 countries across 4 time periods for a total of 601 observations except for the * variables. There are 105 countries across three time periods for 169 observations for *WBES Corruption Experience*. There are 149 countries across four time periods for 544 observations for *Education*. There are 163 countries across four time periods for 593 observations for *Resource Rents* and *Resource Rents x Democracy*.

Business to Have to Pay Some Irregular 'Additional Payments' to Get Things Done."

V. Empirical Results

We next estimate our empirical models (1) and (2). We start with our baseline panel regression estimators in tables 3 and 4. We then use GMM to control for endogeneity in tables 5–9.

A. Baseline Results

Table 3 presents the P-OLS, RE, and FE results. The results for the corruption equation (1) are shown in the left panel. The coefficient for *Economic Freedom* is negative and statistically significant under P-OLS. This negative relationship between freedom and corruption is consistent with the results of Treisman (2000), Paldam (2002), and Goel and Nelson (2005). However, the coefficient for *Economic Freedom* becomes insignificant when random or fixed country effects are included. The signs and significance of the other variables correspond to the theoretical predictions. The coefficients for *GDP per Capita*, *FDI*, and *Political Stability* are all negative and strongly significant. Likewise, those for the time-invariant *Former British Colony* and *Protestantism* are also negative. As for the *Z* variables, *Education* and *Resource Rents* x *Democracy* are negatively related to corruption, while *Democracy* is positively linked.

The results for the freedom equation (2) are shown on the right panel. Here, the coefficient for *Corruption* is negative and statistically significant in all instances. Regardless of how unobserved heterogeneity is controlled for, we find a strong negative relationship between corruption and economic freedom. As for the *X* variables, economic freedom is positively related to *GDP per capita* and *Former British Colony*; and negatively related (but marginally significant) to *Political Stability* and *Protestantism*. More importantly, there is a negative relationship between freedom and the geographic instruments *Area* and R*emoteness.*

Corruption and economic freedom, however, are likely to be determined simultaneously, leading to endogeneity bias in each regression. We therefore use our GMM estimators to isolate a causal connection between the two variables. Before that, we examine the reduced-form equations to investigate our identification strategy.

Table 3. Determinants of Corruption and Economic Freedom

Dep. variable =		*Corruption*			*Econ freedom*	
Estimator	P-OLS	RE	FE	P-OLS	RE	FE
Econ Freedom	–0.236***	–0.087	–0.086			
	(0.080)	(0.059)	(0.062)			
Corruption	–0.272***	–0.262***	–0.022	–0.260***	–0.123***	–0.093*
	(0.040)	(0.030)	(0.072)	(0.043)	(0.039)	(0.051)
ln(*GDP per cap*)	–0.009**	–0.006**	–0.006*	0.093***	0.159***	0.383***
	(0.004)	(0.003)	(0.003)	(0.030)	(0.026)	(0.067)
FDI	–0.284***	–0.246***	–0.218***	0.003	–0.000	0.001
	(0.049)	(0.039)	(0.048)	(0.004)	(0.003)	(0.003)
Pol Stability	–0.225***	–0.220***		–0.075	–0.026	–0.021
	(0.066)	(0.073)		(0.047)	(0.038)	(0.039)
Former British	–0.006***	–0.009***		0.090*	0.141***	
Colony	(0.002)	(0.002)		(0.053)	(0.055)	
Protestantism	0.027**	–0.012	–0.084*	–0.002	–0.002	
	(0.013)	(0.014)	(0.046)	(0.001)	(0.001)	
Education	–0.056***	–0.076***	–0.055*			
	(0.019)	(0.020)	(0.030)			
Democracy	0.0028***	0.0022***	0.0005			
	(0.0010)	(0.0006)	(0.0009)			
Resource Rents	–0.236***	–0.0870	–0.0858			
x *Democracy*	(0.080)	(0.059)	(0.062)			
ln(*Area*)				–0.026**	–0.019*	
				(0.012)	(0.011)	
ln(*Remoteness*)				–0.552***	–0.492***	
				(0.099)	(0.101)	
Observations	541	541	541	601	601	601
Countries	148	148	148	164	164	164
R-squared	0.851	0.814	0.171	0.508	0.480	0.290
Hausman Test			64.71			56.71
[*p*-value]			[0.000]			[0.000]

Note: Results for the corruption equation are in the left panel and the freedom equation in the right panel. Each equation includes a constant and fixed time effects, which are not shown. Cluster-robust standard errors are in parentheses where ***, **, and * indicate significance at the 1%, 5%, and 10% levels. The R-squared is the overall for P-OLS and RE and the within for FE. The Hausman test is a test of RE versus FE.

B. Reduced-Form Estimates

Reduced-form regressions estimate the effects of all instrumental variables and other exogenous variables on the dependent and endogenous variables. These reduced-form regressions are unbiased if the instruments are valid. As a result, they can provide valuable information on the identification scheme (Murray 2006). If the excluded instruments (*G*) are statistically insignificant in the regression of the dependent variable of interest (*corruption*), then one can infer that either the endogenous variable (*freedom*) does not matter for the dependent variable of interest (*corruption*) or that the model is underidentified. If, however, the excluded instruments (*G*) have opposite signs in the regression of the dependent variable of interest (*corruption*) relative to the regression of the endogenous variable (*freedom*), then one can infer that the endogenous variable will have a larger impact on the variable of interest.

Table 4. Reduced-Form Regressions

Dep. variable =	Corruption		Econ freedom	
Estimator	P-OLS	RE	P-OLS	RE
Z Variables				
Education	0.025*	–0.013	0.020	0.007
	(0.0141)	(0.0146)	(0.0182)	(0.017)
Democracy	–0.075***	–0.065***	0.029	0.035
	(0.021)	(0.021)	(0.025)	(0.024)
Resource Rents x	0.003***	0.001**	–0.002**	–0.001
Democracy	(0.001)	(0.001)	(0.001)	(0.001)
chi-squared statistic	28.73	23.11	15.79	10.34
[*p*-value]	[0.000]	[0.000]	[0.002]	[0.016]
G Variables				
ln(*Area*)	0.010	0.041**	–0.030**	–0.030**
	(0.017)	(0.018)	(0.014)	(0.014)
ln(*Remoteness*)	–0.094	–0.064	–0.533***	–0.533***
	(0.187)	(0.187)	(0.110)	(0.117)
chi-squared statistic	0.650	5.395	23.33	21.04
[*p*-value]	[0.723]	[0.077]	[0.000]	[0.000]
Observations	541	541	541	541
Countries	148	148	148	148
R-squared	0.845	0.835	0.497	0.485

Note: Each column is a reduced form with all variables for the corruption equation in the left panel and the freedom equation in the right panel. Each equation includes a constant and fixed time effects, which are not shown. Cluster-robust standard errors are in parentheses where ***, **, and * indicate significance at the 1%, 5%, and 10% levels. The *chi-squared statistic* and [*p*-value] is a test of joint significance of the variables listed above.

Table 4 presents the reduced-form regression results. Each regression includes all *X*, *Z*, and *G* variables. For compatibility, we estimate each equation using both P-OLS and RE. We show the coefficients values for the *Z* variables in the top panel and those for the *G* variables in the bottom panel. We also include a chi-square test of the joint significance of the instruments in each panel.

The reduced-form regressions show that higher resource rents and lower democracy are associated with greater corruption and less economic freedom, while greater area and remoteness are associated with less economic freedom but have limited impact on corruption. For the *Z* variables, *Democracy* has a negative impact on corruption, while *Education* and *Resource Rents* x *Democracy* have positive effects. Likewise, the *G* variables *Area* and *Remoteness* have negative and significant effects on freedom. However, the coefficients for the *Z* variables have opposite signs and are jointly significant in the corruption equation, while the coefficients for the geography *G* variables are insignificant under P-OLS or marginally significant under RE. These results suggest that the impact of corruption on freedom will be significant, while that of freedom on corruption will be weak at best.

C. GMM Results

Table 5 presents the results of the GMM estimators. The IV-GMM and 3SLS-GMM estimators use the excluded variables *Z* or *G* as instruments, while the system-GMM uses the excluded instruments along with lagged levels and first-differences of each endogenous variable. The specification test results are shown at the bottom. The first-stage *F*-statistics are greater than 10 in all but one instance, indicating that our instruments are relatively strong (Staiger and Stock 1997). Likewise, we fail to reject the Hansen overidentification test at the 10 percent level, suggesting that our instruments are exogenous.

The GMM results find that corruption lowers economic freedom, while freedom has no significant impact on corruption. In the left panel, the coefficient for economic freedom is positive and statistically insignificant in each instance. These results suggest that freedom at best has no impact on corruption and at worse leads to an increase in corruption. In the right panel, the coefficient for corruption is negative and strongly significant for each estimator. In terms of magnitude, a one sample standard deviation increase in corruption decreases economic freedom by 0.70 to 1.47 standard deviations.[8] The next largest effect is remoteness, where a one-sample standard deviation increase decreases economic freedom by a 0.25 to 0.28 standard deviation.

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[8] The standardized or "beta coefficients" of Goldberger (1964) are obtained by converting each variable into the standardized form of $y^{*} = (y - \bar{y}) / sd(y)$, where y^{*} is the mean and $sd(y)$ is the standard deviation.

Table 5. Determinants of Corruption and Economic Freedom Using GMM

Dep variable =	*Corruption*			*Econ freedom*		
Estimator	IV	3SLS	System	IV	3SLS	System
Econ Free	0.038	0.134	0.105			
	(0.300)	(0.296)	(0.194)			
Corruption				–0.582***	–0.583***	–0.287***
				(0.164)	(0.174)	(0.094)
ln(*GDP per cap*)	–0.303***	–0.339***	–0.304***	0.002	0.002	0.066
	(0.060)	(0.057)	(0.078)	(0.050)	(0.051)	(0.060)
FDI	–0.011**	–0.012**	–0.020**	0.001	0.001	–0.007
	(0.005)	(0.005)	(0.008)	(0.004)	(0.004)	(0.006)
Pol Stability	–0.286***	–0.278***	–0.155	–0.147**	–0.153**	0.084
	(0.047)	(0.046)	(0.105)	(0.068)	(0.074)	(0.063)
Former British	–0.269***	–0.280***	–0.152	-0.035	-0.038	0.137*
Colony	(0.081)	(0.082)	(0.110)	(0.068)	(0.072)	(0.082)
Protestantism	–0.006***	–0.006***	–0.023***	–0.005***	–0.005***	–0.012**
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.006)
Education	0.0221	0.0265*	0.042			
	(0.015)	(0.015)	(0.042)			
Democracy	–0.077***	–0.088***	–0.101**			
	(0.026)	(0.026)	(0.049)			
Resource Rents	0.003**	0.003**	0.004			
x *Democracy*	(0.001)	(0.001)	(0.003)			
ln(*Area*)				–0.018	–0.020	0.003
				(0.015)	(0.015)	(0.017)
ln(*Remoteness*)				–0.543***	–0.528***	–0.520***
				(0.106)	(0.111)	(0.143)
Observations	541	541	541	541	541	601
Countries	148	148	148	148	148	164
Instruments	2	44	44	3	3	45
First-stage *F*-stat	11.66	11.66	11.22	9.58	9.58	9.58
Hansen *J*-stat	0.635	0.635	38.37	3.98	3.98	3.98
[*p*-value]	[0.426]	[0.426]	[0.170]	[0.137]	[0.137]	[0.176]

Note: Results for the corruption equation are in the left panel and the economic freedom equation in the right panel. The excluded instruments used for *Economic Freedom* are ln(*Area*) and ln(*Remoteness*); and for *Corruption* are *Democracy*, *Education*, and *Resource Rents* x *Democracy*. Each equation includes a constant and fixed time effects, which are not shown. Cluster-robust standard errors are in parentheses where ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 5 provides initial support for the grabbing hand theory of corruption. Under a self-interested government, regulatory policy is used to create economic rents. As a result, corruption leads to less economic freedom. However, we still need to examine the empirical connections between corruption and the individual components of freedom before passing judgement.

D. Individual Components of Economic Freedom

Table 6 tests the impact of the components of economic freedom on corruption. In each column, we estimate the corruption equation (1) using a different component of economic freedom. The IV-GMM estimates are shown on the top panel and the system-GMM estimates are displayed in the bottom panel. The results show that only rule of law has the potential to lower corruption, while limited (less) government can raise corruption. The negative coefficient for *Rule of Law* may be more a consequence of *Rule of Law* and *Corruption* measuring a related concept, rather than an underlying causal effect.[9] The positive coefficient for *Limited Government*, however, suggests that the decrease in government wages raises corruption more than the decrease in the number of corrupt regulators.[10]

Table 7 tests the impact of corruption on the components of economic freedom. We estimate the freedom equation (2) using a different component as the dependent variable. In each column, we find that corruption lowers *Rule of Law*, *Open Markets*, and, to a lesser extent, *Regulatory*, but raises *Limited Government*. As before, the negative coefficient for *Rule of Law* may be a result of corruption and rule of law measuring similar concepts. The negative coefficient for *Open Markets*, however, indicates that corruption lowers competition as with Emerson (2006). The positive coefficient for *Limited Government* suggests that corruption may actually reduce the size of government.

Tables 6 and 7 provide further support for the grabbing hand theory of corruption. As predicted, we find that corruption lowers *Rule of Law*, *Open Markets*, and *Regulatory Efficiency*. These results support the idea of a nonbenevolent government enacting inefficient regulation to create economic rents. At the same time, corruption increases *Limited Government*, which contradicts the predictions of the public choice theories of Buchanan and Wagner (1977). Given that limited government is measured by the ratio of tax revenue and government spending to GDP, it may be the case that larger

[9] The *Rule of Law* component is the average value of Freedom from Corruption (which is removed in our analysis) and Property Rights. Both subcomponents are similar in that they record the unlawful expropriation of private property by other citizens and government (Property Rights) and by government (Corruption). The similarity of the two subcomponents is also borne out by the high correlation (–0.85) between Property Rights (used as our *Rule of Law*) and the *Corruption* measure from the World Bank.

[10] Fisman and Gatti (2002) and Graeff and Mehlkop (2013) also found a positive and significant link between *Limited Government* and corruption.

governments require less corruption to raise more tax revenue and to borrow.

Table 6. The Impact of Components of Economic Freedom on Corruption

Dep variable =	*Corruption*	*Corruption*	*Corruption*	*Corruption*
Rule of Law	–0.373			
	(0.467)			
Limited Government		0.056		
		(0.127)		
Regulatory Efficiency			–0.022	
			(0.438)	
Open Markets				–0.076
				(0.358)
Observations	541	541	541	541
Countries	148	148	148	148
Instruments	2	2	2	2
First-stage *F*-stat	0.931	31.62	2.988	2.587
Hansen *J*-stat	0.488	0.492	0.651	0.646
[*p*-value]	[0.485]	[0.483]	[0.420]	[0.421]

Note: The Corruption equation (1) is estimated by IV-GMM. The excluded instruments used are ln(Area) and ln(Remoteness). The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep variable =	*Corruption*	*Corruption*	*Corruption*	*Corruption*
Rule of Law	–0.263**			
	(0.108)			
Limited Government		0.266***		
		(0.097)		
Regulatory Efficiency			0.114	
			(0.176)	
Open Markets				–0.086
				(0.127)
Observations	541	541	541	541
Countries	148	148	148	148
Instruments	44	44	44	44
First-stage *F*-stat	35.67	11.92	18.43	17.84
Hansen *J*-stat	42.74	31.60	30.74	39.07
[*p*-value]	[0.078]	[0.436]	[0.479]	[0.151]

Note: The Corruption equation (1) is estimated by system-GMM. The excluded instruments used for *Economic Freedom* are ln(*Area*) and ln(*Remoteness*); and for *Corruption* are *Democracy*, *Education*, and *Resource Rents* x *Democracy* and lagged values of the right-hand side variables. The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7. The Impact of Corruption on Components of Economic Freedom

Dep variable =	*Rule of Law*	*Limited Government*	*Regulatory Efficiency*	*Open Markets*
Corruption	–1.004***	0.283	–0.316	–1.290***
	(0.290)	(0.244)	(0.209)	(0.277)
Observations	541	541	541	541
Countries	148	148	148	148
Instruments	3	3	3	3
First-stage *F*-stat	9.575	9.575	9.575	9.575
Hansen *J*-stat	9.624	10.26	0.977	11.28
[*p*-value]	[0.008]	[0.005]	[0.614]	[0.003]

Note: The Economic Freedom equation (2) is estimated by IV-GMM. The excluded instruments used are *Democracy*, *Education*, and *Resource Rents* x *Democracy*. The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dep variable =	*Rule of Law*	*Limited Government*	*Regulatory Efficiency*	*Open Markets*
Corruption	–1.257***	0.600***	–0.192	–0.710***
	(0.171)	(0.163)	(0.116)	(0.168)
Observations	601	601	601	601
Countries	164	164	164	164
Instruments	45	45	45	45
First-stage *F*-stat	26.32	7.622	11.43	11.50
Hansen *J*-stat	40.35	41.58	34.92	46.26
[*p*-value]	[0.177]	[0.145]	[0.377]	[0.063]

Note: The Economic Freedom equation (2) is estimated by system-GMM. The excluded instruments used for *Economic Freedom* are ln(*Area*) and ln(*Remoteness*); and for *Corruption* are *Democracy*, *Education*, and *Resource Rents* x *Democracy* and lagged values of the right-hand side variables. The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

E. Different Income Levels

We next test the robustness of our results across different income levels. Cross-sectional regressions by Graeff and Mehlkop (2003) show that the magnitude and even the coefficient sign of economic freedom varies depending upon the level of development. Using the 1995 income classification of the World Bank, we divide our data into two samples: poor (low and low-middle income) and rich (high-middle and high-income) countries. We then estimate the effects of economic freedom on corruption (table 8a) and corruption on freedom (table 8b) in each sample. The results clearly show that corruption lowers economic freedom across both income groups, while freedom only has a marginal impact on corruption in the rich countries. These results indicate that our earlier finding that corruption lowers freedom is robust to all development levels.

Table 8a. The Impact of Economic Freedom on Corruption across Income Groups

Dep variable =	*Corruption*		*Corruption*	
Estimator	IV	System	IV	System
Econ Freedom	0.675	0.001	–0.309	–0.354
	(0.728)	(0.222)	(0.303)	(0.240)
Sample	Poor	Poor	Rich	Rich
Observations	354	354	187	187
Countries	99	99	49	49
Instruments	2	39	2	39
First-stage F-stat	1.939	1.451	9.826	16.35
Hansen J-stat	1.182	33.77	0.329	28.86
[p-value]	[0.277]	[0.141]	[0.566]	[0.317]

Note: The Corruption equation (1) is estimated with the excluded instruments of ln(*Area*) and ln(*Remoteness*). The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8b. The Impact of Corruption on Economic Freedom across Income Groups

Dep variable =	*Econ Freedom*		*Econ Freedom*	
Estimator	IV	System	IV	System
Corruption	–0.824***	–0.480***	–0.311**	–0.323***
	(0.221)	(0.171)	(0.139)	(0.120)
Sample	Poor	Poor	Rich	Rich
Observations	354	405	187	196
Countries	99	113	49	51
Instruments	3	39	3	39
First-stage F-stat	9.507	10.30	11.87	13.34
Hansen J-stat	3.020	29	2.460	25.93
[p-value]	[0.221]	[0.361]	[0.292]	[0.523]

Note: The Economic Freedom equation (2) is estimated with the excluded instruments of *Democracy*, *Education,* and *Resource Rents* x *Democracy*. The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

F. WBES Corruption Experience Measure

We also test the sensitivity of our results to the WBES corruption experience measure.[11] We estimate the effects of economic freedom on corruption experience (table 9a) and corruption experience on freedom (table 9b).

Table 9a. The Impact of Economic Freedom on WBEF Corruption

Dep Variable =		*WBEF Corruption*		*WBEF Corruption*	
Estimator	IV	3SLS	System	IV	IV
Econ Freedom	–0.467**	–0.517***	–0.130	1.049	–0.064
	(0.192)	(0.193)	(0.135)	(2.671)	(0.072)
Sample	All	All	All	Poor	Rich
Observations	169	169	169	141	28
Countries	107	107	107	89	28
Instruments	2	2	39	2	2
First-stage *F*-stat	4.880	4.880	2.313	2.287	11.08
Hansen *J*-stat	1.432	1.432	45.52	3.234	4.855
[*p*-value]	[0.231]	[0.231]	[0.026]	[0.072]	[0.029]

Note: The Corruption equation (1) is estimated with the excluded instruments of ln(*Area*) and ln(*Remoteness*). The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 9b. The Impact of WBEF Corruption on Economic Freedom

Dep variable =		*Econ Freedom*		*Econ Freedom*	
Estimator	IV	3SLS	System	IV	IV
WBEF Corruption	–0.631	–1.758**	–0.694**	–2.664*	–1.026
	(0.868)	(0.769)	(0.289)	(1.131)	(1.698)
Sample	All	All	All	Poor	Rich
Observations	169	169	169	141	28
Countries	107	107	107	89	28
Instruments	3	3	49	3	3
First-stage *F*-stat	3.884	3.884	8.160	1.974	4.711
Hansen *J*-stat	4.333	4.333	36.67	1.345	7.433
[*p*-value]	[0.115]	[0.115]	[0.531]	[0.505]	[0.024]

Note: The Economic Freedom equation (2) is estimated with the excluded instruments of *Democracy*, *Education*, and *Resource Rents* x *Democracy*. The coefficients for the other regressors, intercept term, and time dummies are not shown. Cluster-robust standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

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[11] We would like to thank an anonymous referee for suggesting that we use the WBES corruption experience measure.

The whole sample is used in the first three columns and split into poor and rich countries in the last two columns. Due to the smaller country coverage and shorter horizon of the WBES data, the instruments are weak even under system GMM.

Nevertheless, we do find some evidence that economic freedom can reduce corruption. Under IV-GMM and 3SLS-GMM, freedom reduces the experience of corruption. However, this result does not hold when we estimate each income group separately. At the same time, we continue to find that corruption reduces freedom, although the statistical significance is reduced.

VI. Conclusion

This paper examined the empirical relationship between corruption and economic freedom. We used a principal-agent-client model to develop theoretical possibilities for freedom to lower corruption under a helping hand and for corruption to lower freedom under a grabbing hand. Using a series of panel GMM estimators, we found strong and robust evidence that corruption lowers economic freedom, but little evidence that freedom reduces corruption.

Instead, we found that GDP per capita, FDI, political stability, democracy, and resource rents are all significant determinants of corruption. Policy implications from these results are complicated because a country cannot abruptly increase output, FDI, democracy, or reliance on natural resources. However, developed countries could give aid conditional upon improved efficiency and productivity and greater democracy with the goal of easing corruption. By investing in areas such as infrastructure, research and development, education, and job training, a country could reduce corruption. As per our results, this decrease in corruption will lead to advances in economic freedom.

Our paper has important implications for estimating the impact of economic freedom and corruption on economic growth. First, given that corruption lowers economic freedom, previous estimates of the negative impact of corruption on growth may be understated. The total impact of corruption on growth is the sum of the direct impact plus the indirect impact via freedom. Second, recent evidence that corruption can "grease the wheels" of economic growth (Méon and Sekkat 2005; Méon and Weill 2010; Johnson et al. 2014) may be somewhat exaggerated. By not accounting for the impact of corruption on economic freedom, the estimated marginal impact of corruption on growth conditioned on initial freedom is biased upward.[12] By estimating a threshold model, Aidt, Dutta, and Sena (2008) confirm this by finding a strong negative relationship between corruption and growth in the high quality institutions regime and no relationship in the low quality institutions regime. Third, proper identification of economic freedom and/or corruption is essentially to uncovering the correct impact on growth. Failure to do so can result in substantial endogeneity bias.

We plan to use our empirical methodology to estimate other consequences of corruption. For instance, what happens to the effects of corruption on trade and foreign direct investment when corruption is identified by our instruments? Similarly, what happens to the effects on poverty and inequality? We plan to answer these questions in future research.

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[12] In the "grease vs. sand the wheels" debate on corruption, the following growth equation is estimated: $growth_{i,t+1} = \beta_0 + \beta_1 corruption_{i,t} + \beta_2 corruption_{i,t} \times freedom_{i,t} + e_{i,t}$, so the marginal impact is calculated as $\frac{\partial growth_{i,t+1}}{\partial corruption_{i,t}} = \beta_1 + \beta_2 freedom_{i,t}$, where $\beta_1 < 0$ and $\beta_2 > 0$. With corruption lowering freedom, *freedom* would decrease and thus the total effect would be lower.

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