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RESEARCH ARTICLE

Perceived corruption, economic freedom, and firms in India

Nabamita Dutta[1], Adam Stivers[1] and Saibal Kar[2,3]

[1]University of Wisconsin – La Crosse, La Crosse, Wisconsin, USA, [2]Center for Studies in Social Sciences, Calcutta, India and [3]IZA, Bonn, Germany
Corresponding author: Adam Stivers; Email: astivers@uwlax.edu

Abstract
Research has shown that the relationship between economic freedom and corruption is rather complex. While some studies suggest a negative relationship, others show the matter to be more nuanced. While more regulations are known to foster corrupt institutions, a competitive market can also incentivize bribery and corruption. Our study examines the role of economic freedom as it relates to perceived corruption, measured via a survey for India. Using firm-level data, we explore the relationship between perceived corruption in the formal sector and economic freedom across Indian states. In our baseline results for Indian firms, we find a significantly negative relationship between perceived corruption and lagged economic freedom. These results hold when we design matching models and include a number of potentially confounding factors to control for identification issues. Additionally, we show that small and young firms and those with sole ownership perceive greater benefits from higher economic freedom. In contrast, older firms perceive higher corruption when economic freedom is higher. This lends support to the idea that competition facilitated by economic freedom can increase rent seeking behavior. Our study contributes to the literature by emphasizing that the relationship between economic freedom and corruption in India is layered, with firm characteristics playing a crucial role.

Keywords: Perceived corruption; economic freedom; firm size; ownership; India

Introduction

Do countries with greater levels of economic freedom tend to have lesser corruption? While some empirical studies do report this negative relationship (e.g., Carden and Verdon, 2010; Goel and Nelson, 2010; Shen and Williamson, 2005; Paldam, 2002; Chafuen and Guzmàn, 2000), the matter is substantially more complex. A negative relationship would be expected if, as Rose-Ackerman (1999) argues, higher regulation or government involvement in markets, and therefore less freedom, result in more opportunities for corruption. A heavily regulated market increases the incentive to avoid regulations by paying a bribe, for example (see, Glaeser and Saks, 2006). However, paradoxically, a positive relationship between economic freedom and corruption may also result if fewer regulations and free entry in the markets jeopardizes the existence of firms, which would then engage in corruption to fend off competition.

The present research question is an integral part of a larger debate centering on how corruption affects growth (i.e., whether corruption and its manifestation as bribery is inherently bad for a nation's economic prospects). The literature seems to argue that the relationship is nonlinear. A recent study (Uberti, 2022) uncovers two centuries of cross-country data on corruption and finds that it has negatively affected the steady state growth; more so in democracies and those with dysfunctional institutions, rather than in autocracies. The role of institutions and markets that are influenced by economic freedom is therefore closely associated with how corruption affects growth and inequality. For example, Heckelman and Powell (2010) argue that when economic freedom is low, corruption can increase efficiency. This is in line with the idea that burdensome regulations lead to payment of bribes

for greasing the wheels. Swaleheen and Stansel (2007) argue the opposite, however. They suggest that corruption can be good for economic growth in less regulated countries but bad for economic growth in heavily regulated countries.

Regardless of the effect on growth, the literature has thus far shown that the relationship between economic freedom and corruption is, at best, fragmented. First, the assumption that (lack of) economic freedom causes corruption may be faulty. Apergis *et al.* (2012) find the causality to be bidirectional, at least for the United States.[1] Corrupt states are likely to result in government officials increasing regulations to create more opportunities for rent seeking. Second, the relationship between economic freedom and corruption has been found to differ across types of economic freedom (e.g., Goel and Nelson, 2010; Graeff and Mehlkop, 2003). Further, the relationship has been found to differ across groups of countries. Graeff and Mehlkop (2003) find that these patterns differ by the level of per capita income in a country, or more generally, whether these are rich or poor. For example, Pieroni and d'Agostino (2013) combine firm level and macro data to show that the relationship between economic freedom and corruption depends on the country's stage of economic development and on the quality of its institutions. On a related note, Billger and Goel (2009) use quantile regressions to show that, for the most corrupt countries, greater economic freedom does not reduce corruption. Thus, the relationship between economic freedom and corruption is not straightforward and should benefit from more elaborate empirical analysis especially for countries where corruption is significant, sources of information complex and incomplete, and hence insufficient scientific evidence deter corrective courses.

Given this perspective, the present study engages with firm-level perceived corruption for India, which remains considerable despite measures such that, as of 2023 it ranks 93 out of 180 countries (Transparency International [TI], 2023) with the rank receding by 8 places since 2022. According to the index used by TI, lower ranks along with higher scores imply less corruption for a country. For example, Denmark is ranked 1 with a score of 91, while Somalia is ranked last (167) with a score of 8. Countries such as Kazakhstan, Lesotho, and Maldives are ranked similarly as India, while China ranks better at 74th and South Africa ranks 83rd among BRICS countries of which India is a member. It needs to be emphasized that about 89% of individuals surveyed think that *government corruption is a big problem (*TI, 2023) and 39% stated that they had to *pay a bribe to receive public service of one or more types*.[2] Other indices based on corruption also rank India to be high risk in terms of corruption (for example, the Trace Bribery Risk Matrix ranks India to be 77th out of 194 countries).

As mentioned earlier, studies exploring corruption and its implications for formal or informal sectors in India are few in number due to poor availability of data. Earlier, Dutta, Kar, and Roy (2013) have employed cross-sectional data across states to explore the relationship between the size of the informal sector and corruption. More recently, using World Bank Enterprise Survey (WBES)[3] firm-level data, Dutta, Kar, and Beladi (2022) show that firms' probability to innovate falls when firms perceive more corruption, and the relationship is nonlinear. Indeed, using bribery data as a measure of corruption, Sharma and Mitra (2015) show that while corruption negatively affects firms' efficiency, it does help with respect to export and product innovation. Notwithstanding, similar data for India with wider coverage in the presence of better controlling factors, including economic freedom, should improve our understanding of the effects of corruption perception on various economic and political choices made by the enterprises and individuals.

More precisely, our contribution lies in employing extensive firm-level data to explore the relationship between economic freedom and perceived corruption for the formal sector, a relationship unexplored in the literature for the Indian context. Additionally, we investigate the nonlinearity in the relationship between economic freedom and perceived corruption by considering firm characteristics. We examine if economic freedom's association with perceived corruption is conditional on firm

[1]The present paper also tests for bidirectionality for our data and the result is available in section 5.1.

[2]BRICS countries is a loosely formed economic consortium (since 2009) for high growth countries, namely, Brazil, Russia, India, China, and South Africa. Brazil and Russia are ranked around 130 and below for most rounds.

[3]The World Bank Enterprise Surveys, 2014. http://www.enterprisesurveys.org.

characteristics such as location, size, age, and ownership structure. Studies such as Wu (2009) find that firm characteristics are strong determinants of bribery. Many studies have explored the relationship between firm size and corruption and the conclusions remain ambiguous as well (Schiffer and Weder, 2001; Wu, 2009; Martin et al, 2007; Clarke and Xu, 2004). Nguyen (2020) employs an innovative identification strategy to find that bigger firm size leads to greater corruption. In the context of age, using Armenian data Sahakyan and Stiegert (2012) find that younger firms are likely to perceive corruption favorably. Firms in India too, along with size class distribution, enjoys different levels of political connections owing to dynastic ownership structures and via independent approaches (see Ahmad and Chahal, 2023 for political donations by firms and technology transfers received; Ganguly *et al*. 2023, etc.). These connections take the form of political donations, and presence of political influence in the board (corporate governance), that in a broader sense can be considered as manipulation and corrupt practices. We explore the relation between economic freedom and perceived corruption for the firms in India as captured by a specific survey data that we discuss shortly.

The rest of the paper proceeds as follows. Section 2 provides the theoretical arguments for the paper along with providing further context for corruption in the Indian context. Section 3 describes the data source, our sample, and our variables. Section 4 describes the empirical methodology as well as the benchmark results. In Section 5, we describe the robustness of our findings, which includes identification. The results demonstrating the nonlinearity of the relationship by incorporating interaction effects are clarified in Section 6. Section 7 concludes.

Related literature

Before deliberating on the related evidence, let us briefly submit the findings in order to highlight the extant contribution. We find a significantly negative relationship between lagged economic freedom and perceived corruption. This relationship holds after controlling for a host of firm variables, such as size, age of firm, ownership structure, and industry fixed effects. We also control for other potentially confounding factors: whether the firm has a loan or not, whether the firm was recently visited by a tax official, number of employees, and firm location. In addition, we control for whether the interviewer perceives that the respondent was truthful or not. With all these controls in place, we find an even stronger negative relationship between economic freedom and perceived corruption.

While this is the first (to the best of our knowledge) study that triangulates for India the association between firm level characteristics, corruption perception, and economic freedom, earlier literature finds both positive and negative relationships to exist between economic freedom and corruption, only. The negative relationship holds because lower economic freedom in the form of heavy regulation results in more opportunities for corruption (Rose-Ackerman, 1999). In other words, regulations increase the incentive to bypass these by paying bribes (Glaeser and Saks, 2006). However, Apergis *et al.* (2012) find that while there is some evidence of this causality, corruption can also lead to fall in economic freedom. Further, both causality and directionality have been shown to vary based on the subcomponent of economic freedom indices examined and the countries' stage of development, income level, or prevailing corruption level (e.g., Goel and Nelson, 2010; Billger and Goel, 2009; Graeff and Mehlkop, 2003). On average, cross-country evidence generally supports a negative relationship between economic freedom and corruption (e.g., Carden and Verdon, 2010; Chafuen and Guzmàn, 2000; Goel and Nelson, 2010; Paldam, 2002; Shen and Williamson, 2005). For India, the dominant expectation would also be a fall in corruption with greater economic freedom. We propose the following to be verified empirically in the following section.

Proposition 1: *As economic freedom rises across Indian states, perceived corruption will fall.*

Since India is ranked about the median value of cross-country corruption and yet ranks low given the economic achievements over the last three decades, it is possible that greater economic freedom is a source of corruption, instead (see, Billger and Goel, 2009 for similar arguments). Intuitively, it could be an outcome of leaning on to corrupt behavior at the firm level in order to remain competitive

(violations of regulations and bribing of inspectors are common instances, see Marjit and Kar, 2012). Also, Collins *et al.* (2009) find that executives in India view corruption as necessary to compete.

Further, there is much evidence that corruption propensity differs based on various firm characteristics. Wu (2009) argues and finds support for smaller firms and family firms (or sole-ownership firms) being more prone to paying bribes than larger firms and firms with boards or external owners, respectively, in Asia. Mendoza *et al.* (2015) find that corruption can be helpful for small- and medium-sized firms in the Philippines as also for cities with poor business environment. However, other evidence is mixed on the relationship between firm size and corruption, with some finding larger firms to exhibit greater corruption (see Nguyen, 2020; Martin *et al.*, 2007; Clarke and Xu, 2004; Schiffer & Weder, 2001). Campos and Giovannoni (2007) find that lobbying and corruption are substitutes and that larger firms, older firms (similarly in Fatima and Khan, 2021), public firms, firms located in the capital city, and firms in wealthier nations are more likely to lobby.

To comprehend, greater economic freedom increases competition such that firms might resort to corrupt practices in order to stay afloat, while sufficient expansion of opportunities for businesses could lower the perceived ability to seek rent among public officials. We also know that firm location can affect its propensity for lobbying/corruption (Campos and Giovannoni, 2007). As the evidence on firm characteristics and corruption is mixed, and as the mechanism behind corruption may be due to either high economic freedom (i.e., highly competitive markets) or low economic freedom (i.e., burdensome regulations), we argue that there is no clear directionality to expect from these interactions. Thus, formally we have our second proposition.

Proposition 2: The relationship between economic freedom and corruption for Indian firms is affected by the firm's size, age, location, and corporate governance structure.

Data description, the sample and the variables

The data source

World Bank Enterprise Surveys (i.e., WBES, 2022) are the main source for our data. It is a popular micro level data source in the entrepreneurship literature for studies employing firm level information (available studies include Dutta and Mallick, 2023; Adegboye and Iweriebor, 2018; Eifert, Gelb and Ramachandran, 2008; Page and Söderbom, 2015; Williams and Kedir, 2019). The survey constitutes a representative sample from the private sector establishments providing information on firm performance and firm characteristics. The WBES includes any formally registered firms with more than 1 percent private ownership and having greater than five employees. The information gathered from the surveys covers firm's age, size, location, sales, infrastructure, management practices, business–government relations, regulations, and competition. Additionally, several questions are asked on firms' perception about different kinds of obstacles in terms of accessing finance, infrastructure facilities, and importantly, their perception on corruption.

The Enterprise Survey (ES) methodology[4] employs a consistent definition of the universe of inference along with a uniform methodology of implementation as well as a standard sampling methodology. Stratified random sampling has been considered with three levels of stratification: sector of activity, firm size, and location within a country. Sampling weights have been used to account for non-response.

Our sample

The most recent wave of data from WBES for India is considered for our empirical analysis. 2022 is the year for the recent wave of data that includes firm responses from 22 states and 2 union territories—Delhi and Jammu and Kashmir. Response rates as a share of sample observations are equally distributed among the states ranging from 2 percent to 5 percent except for Maharashtra, for which the response

[4]See, Islam et al. (2018).

rate is above 10 percent. Among industry classifications we have 17 sectors that include main industries like food, manufacturing, textiles, hotels, restaurants, and retail. The survey was implemented in India between December 2021 and October 2022.

Other than the most recent survey, the WBES has survey data also for the years 2005, 2009, 2010, and 2014. The specific question of interest for us, "how much of an obstacle is access to finance," was asked for the first time in 2014. Thus, data can be pooled for the years 2014 and 2022 to get a larger sample. But since economic freedom is available only for the years 2013, 2011, 2009, and 2005 for Indian states, we do not have a simple way to construct a panel over time. For our benchmark results, therefore, we consider the most recent wave of firm-level data, i.e., for 2022. Data for the independent variable, namely, economic freedom are from 2005 and 2009. This is done in order to create the longest lags with respect to our dependent variable in an effort to mitigate reverse causality. We elaborate on identification in subsequent sections. Note, the World Bank mentions that a three-level stratified random sampling has been employed for data collection. This is done to make sure that the collected sample provides unbiased estimates for the whole population and that the sample is representative of industries, sectors, and regions (WBES, 2014).

It should be informed that many of the questions in the survey are sensitive in nature. For example, firms are asked about the frequency of inspections by tax officials. For this reason, private contractors are hired by the World Bank to conduct surveys in local languages. Responses are collected via a two-stage procedure. The first step consists of screening the questionnaire, assessing eligibility of participants, and canvassing the questionnaire over phone. A face-to-face interview is conducted in the second stage with either the manager, or the owner, or the director of the firm (establishment). We have 9376 such firms in our sample.

Dependent variable

Based on our proposition 1, the main dependent variable of interest measures perceived difficulties by firms in terms of experiencing corruption. The specific question asked is "*how much of an obstacle is corruption?*" The answers can be as follows: *no obstacle, minor obstacle, moderate obstacle, major obstacle, and very severe obstacle*. Our interpretation of the question is that firms respond with the severity of the corruption they face at all levels based on their experiences. Thus, throughout we refer to this as perceived corruption. Although they are asked how much of an obstacle it is, this can reasonably be inferred as a level of perceived corruption as well. We construct an ordered dummy variable ranging from 0 to 4 with higher numbers indicating stronger perceptions about corruption. The mean of the variable is around 1.2. We have about 44 percent of firms in our sample which respond "no obstacle" in terms of corruption. About 5.5 percent of firms state they are facing "very severe obstacle." Almost 30 percent of our sample responds facing "moderate" to "severe corruption." Interestingly, we find that about 16 percent of small firms respond facing "no obstacle" in terms of corruption. About 13 percent of small firms perceive "moderate" to "severe" to "very severe" corruption. The average perceived corruption levels (based on our ordered variable) by firm size are presented in Figure 1.

Independent variables

Our main independent variable of interest is a measure of economic institutions for the states in India—in our case, *economic freedom*. As mentioned earlier, empirical literature has associated economic freedom with multiple beneficial outcomes including lower corruption (Carden and Verdon, 2010; Goel and Nelson, 2010; Shen and Williamson, 2005; Paldam, 2002; Chafuen and Guzmàn, 2000), as also greater entrepreneurial opportunities, and higher rates of entrepreneurship (Dutta and Sobel, 2020; Sobel, 2015; 2008; Hall and Lawson, 2014; Hall and Sobel, 2008; Kreft and Sobel, 2005; Holcombe, 1998).[5] Economic freedom encompasses policies like secure property rights, a non-corrupt and independent judicial system, contract enforcement, free trade, monetary stability, and effective limits on government taxation and regulation. The source for economic freedom data for India comes from the

[5]See also Berggren (2003), De Haan, Lundstrom, and Sturm (2006), and Gwartney and Lawson (2003).

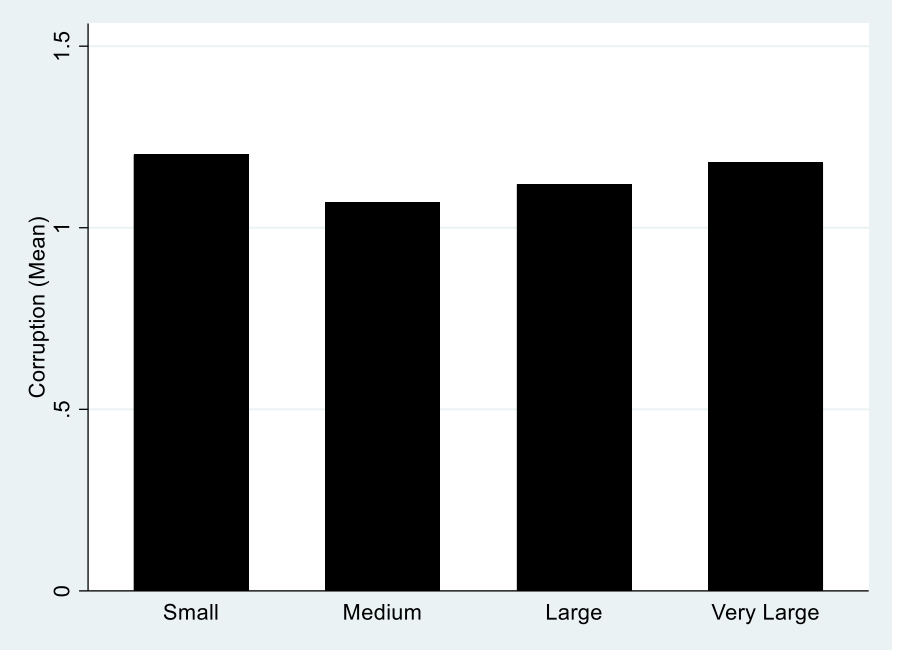


Figure 1. Average corruption perceptions by firm size.
Source: Own calculation.

'Economic Freedom of the States of India 2013' report. The index is based on the Fraser Institute's *Economic Freedom of the World* (EFW) report which is the most popular index used in cross country panel studies investigating relationships based on economic freedom (e.g., Gwartney, Lawson, and Hall, 2015; Gwartney, Lawson, Hall, and Murphy, 2021; Hall and Lawson, 2014). The EFW index continues to be the most popular index even for very recent studies relating freedom to growth and other outcomes (Bergrren and Bjørnskov, 2024; Bergh and Bjørnskov, 2021).

Cato Institute[6] published the EFSI providing information on economic freedom for 2005, 2009, 2011, and 2013 for 20 states in India. Though the original EFW index has five components, only three are used for the EFSI: size of government, legal structure and property rights, and regulation of labor and business. As a starting point, we consider economic freedom for the states for 2005 and 2009. In view of identification, data lagged for more than a decade for the explanatory variable circumvents reverse causality issues to some extent (see, Bellemare *et al.* 2017). We establish identification via different methods which we talk about in greater detail in subsequent sections. The economic freedom data for India varies from 0 to 1 with higher magnitude indicating greater economic freedom. We rescale the data for our analysis so that it ranges from 0 to 10. The mean is 3.9 for our sample with the maximum being 5.7. In Appendix 1, we present the values of Economic Freedom by state for the years 2005 and 2009. The values range from 0.25/0.23 (Bihar) to 0.57/0.59 (Tamil Nadu) in 2005/2009. Most states are fairly consistent across the two waves, with Uttarakhand and Madya Pradesh having the biggest decreases in EFSI at –0.7. Andhra Pradesh and Gujarat had the biggest increases at 0.11.

Controls

Since research on factors influencing corruption perception for firms is rather limited for India, to choose our set of controls we rely on the literature that has investigated constraints on accessing finance and the consequences. Additionally, we also consider a recent strand of literature that investigates how perceptions about accessing finance by firms are affected by different factors. Studies such as Beck and

[6]The Cato Institute is an American libertarian think tank headquartered in Washington, D.C. Obtained from https://www.cato.org/economic-freedom-states-india.

Demirguc-Kunt (2006), Berger and Udell (1998), Dutta and Mallick (2023), and Galindo and Schiantarelli (2003) have suggested that small firms can potentially face stronger growth obstacles and have lesser access to external finance. Based on similar reasoning, they may also perceive higher corruption. WBES do not provide the actual number of employees employed in each firm. Instead, it categorizes firms into small—having more than 5 but less than 19 employees, medium—more than 20 but less than 99 employees, large—between 100 and 199 employees, and finally very large—with more than 200 employees. Other studies such as Dutta and Mallick (2023) and Lee, Sameen and Cowling (2015) have also considered size categories. The data set has about 35 percent small firms, 32 percent medium firms, about 14 percent large firms, and about 15 percent very large firms. We create different dummies indicating firm size—assigning 1 if they are small firms, 0 otherwise; assigning 1 if they are medium firms, 0 otherwise; and assigning 1 if they are large or very large firms, 0 otherwise. We group large and very large firms together. For our benchmark results, we include the medium firm and large firm dummies (combining large and very large firms) considering the small firm[7] dummy as the baseline. The other controls considered are the *age of the firm* and *percent of ownership of the largest owner* of the firm. For the latter, we consider a dummy that is assigned 1 if the largest owner owns 100% of the firm.

The full-sample summary statistics for our variables of interest are presented in Appendix 2. Of note is the average age of about 23 years for firms in our sample, with the ages ranging from 1 year to 184 years. The number of small, medium, and large firms are roughly similar (based on the median values for the dummy variables). Around 70% of firms have a sole owner. The full-sample summary statistics for Economic Freedom (2005 and 2009) are provided as well.

Empirical method and benchmark results

Empirical methodology

Our sample, as mentioned, is based on the 2022 wave from WBES. The other wave that includes the same question about corruption is the 2014 survey for India. Yet, since Economic Freedom across states is only available for four years—2013, 2011, 2009, and 2005, we cannot meaningfully form a panel based on two waves of firm level data and four years of cross-sectional data across the states. Instead, we consider the data for the years based on EFW availability separately. We start with the years 2005 and 2009 to consider the largest lags with respect to our dependent variable as explained above. Nevertheless, endogeneity can still bias our estimates and, thus, we elaborate on identification in later sections.

Our dependent variable, perception about corruption by firm owners, is ordinal in nature. Additionally, the variable has more than two categories, and the values of each category have a meaningful sequential order where a value is indeed 'higher' than the previous one. Under such circumstances, ordered probit or ordered logit is the appropriate model to consider. An ordered probit considers a standard normal distribution, and an ordered logit adopts a logistic distribution.

Our ordered probit specification is considered below

$$\mathrm{Corr}_{\mathrm{ijs}} = \alpha_0 + \alpha_1 \mathrm{EcoFreed}_{\mathrm{s}} + \sum_{\mathrm{k}=1}^{\mathrm{K}} \beta_{\mathrm{k}} \mathrm{X}_{\mathrm{kijt}} + \rho_{\mathrm{i}} + \epsilon_{\mathrm{it}} \quad (1)$$

where $Corr_{ijs}$ is the ordered dummy variable ranging from 0 to 4 for firm i in industry j in state s with higher numbers indicating stronger perceptions about corruption being an obstacle. The variable has been described earlier in the paper in detail. $EcoFreed_s$ are the 2005 and 2009 values for economic freedom for the states considered in separate regressions. X_{kijt} denotes the matrix of control variables. The benchmark controls, as stated earlier, are firm size, age of the firm, and a dummy indicating if the largest owner of the firm owns 100% of the share or not. ρ_{i} represents the industry fixed effects, and ϵ_{it} represents the error term. Since the nature of the data does not let us consider a panel, we instead test our benchmark results for each year separately—2005 and 2009—we are unable to consider state fixed effects

[7]An ordered dummy variable for firm size has also been considered, and our results remain robust.

for our specifications. Based on Proposition 1, we expect α_1 to be negative, indicating that with a rise in economic freedom, the probability of firms perceiving more corruption goes down. Yet, since the findings in the literature are inconclusive in terms of economic freedom, α_1 can also be positive and significant. With higher economic freedom, the pressure to stay competitive rises, and firms might resort to more bribery in order to achieve that. Thus, perceptions about corruption might grow stronger.

Benchmark results

Table 1 presents our first set of benchmark results. We consider 2005 values of economic freedom for Table 1. In the first column, we consider ordered probit specifications with no controls other than industry fixed effects. We present the marginal effects for each level of corruption in Table 1 along with our results. Based on the marginal effects, we find that the conclusions support Proposition 1—higher economic freedom pacifies corruption perception of firms. We do find that when firms perceive corruption as a *minor obstacle* or even a *moderate obstacle*, a unit rise in economic freedom lowers the probability of forms perceiving corruption by less than 1%. When firms perceive *severe* or *very severe* corruption, the rise in economics freedom lowers the probability by a slightly larger amount—perceiving corruption goes down by about 1%.

We add controls systematically in subsequent columns. The first controls added are the firm size indicators as mentioned earlier. Dummies indicating medium firm and large firm (including very large) are included in column (2). In column (3), we include the age of the firm. Finally, in column (4), we include a dummy indicating if an owner has 100% ownership of the firm or not. Our overall conclusions remain unchanged—but with the addition of controls, the magnitude goes down. In Figure 2A, we meaningfully represent the probabilities of perceiving corruption for firms at different perceived levels of the obstacle. For example, when firms perceive minor corruption, a rise in economic freedom is not significantly associated with lowering probability in terms of perceiving less corruption. For moderate, severe, or very severe perceived corruption, economic freedom lowers the probability of perceiving that level of corruption by about 1 percent. In the case of no obstacle (when firms perceive no corruption), it appears that economic freedom raises the probability of perceiving corruption. This may be due to the increased firm competition caused by greater economic freedom resulting in greater propensity for firms to engage with corrupt officials (as in Billger and Goel, 2009 and Collins & Uhlenbruck, 2009). Since it is not the focus of our analysis, we do not present marginal estimates for our controls. In the context of firm size, we find that medium and large firms perceive less corruption relative to small firms, which serves as our baseline. This is not a surprising result as small firms have been shown to be relatively more growth constrained than medium or large firms. Things like accessing credit can be challenging for small firms and, thus, they are likely to perceive more corruption.

In Table 2, we re-run the specifications from Table 1 with economic freedom data from 2009 instead of 2005. Our overall conclusions remain the same as evident from the table. Without any controls, as evident from column (1), we find the magnitude of our results to be similar to Table 1—when the perceived corruption is a severe or a very severe obstacle, the probability of perceiving corruption goes down by about 1% with a rise in economic freedom. Once all controls are added, the magnitude of this perception does not change. We depict the marginal probabilities in Figure 2B similar to Figure 2A considering the specification in column (4) in Table 2.

Robustness analysis

Identification and challenges with IV estimates

Our benchmark results, so far, firmly establish a negative and significant relationship between lagged economic freedom and the perceived corruption of Indian firms. As economic freedom rises, firms perceive less corruption, and the probability of perceiving less corruption rises as the strength of the same rises. However, our results are likely to suffer from endogeneity concerns for several reasons. Among the conflicting findings, as clarified above regarding the relationship between economic freedom and corruption, one is that the association can be bidirectional. This would imply that as firms'

Table 1. Ordered probit specifications: perceived corruption by firms and economic freedom (2005 values)

	(1)	(2)	(3)	(4)
EF2005	−0.041***	−0.041***	−0.030**	−0.031***
	(0.015)	(0.015)	(0.015)	(0.015)
Medium	–	−0.084***	−0.102***	−0.130***
		(0.031)	(0.031)	(0.032)
Large firm	–	−0.001	−0.041	−0.108**
		(0.031)	(0.031)	(0.032)
Age	–	–	0.006***	0.006***
			(0.001)	(0.001)
Percent own	–	–	–	−0.250***
				(0.028)
Industry F.E.	Yes	Yes	Yes	Yes
Observations	8,056	8,056	8,049	8,056
Wald Chi-Sq.	77.79	85.96	143.13	222.
Marginal effects				
No corruption	0.016*** (0.007)	0.016*** (0.007)	0.011** (0.006)	0.012** (0.005)
Minor corruption	−0.0004** (0.0002)	−0.0004** (0.0002)	−0.0003* (0.0001)	−0.0003** (0.002)
Moderate corruption	−0.004*** (0.002)	−0.005*** (0.002)	−0.003** (0.002)	−0.003** (0.002)
Severe corruption	−0.006*** (0.002)	−0.006*** (0.002)	−0.005** (0.002)	−0.005** (0.002)
Very severe corruption	−0.005*** (0.003)	−0.005*** (0.002)	−0.004** (0.002)	−0.004** (0.002)

Ordered Probit Specifications: All firm level data are considered from World Bank Enterprise Surveys 2022 wave. *Corruption* is the dependent variable assessing perceived levels of corruption by the firms. The variable is an ordered dummy variable ranging from 0 to 4 with 0 indicating firms stating, "no perceived corruption," 1 indicating "minor perceived corruption," 2 indicating "moderate perceived corruption," 3 indicating "severe perceived corruption," and 4 representing "very severe perceived corruption." *EF2005final* represents economic freedom for states for the year 2005 considered from Cato Institute database for India. The controls are *firm size* (medium and large with small as the baseline), and *age* of the firm. We control for industry fixed effects. Robust standard errors are reported in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively. We also present the marginal effects for all levels of corruption in the table for a unit rise in economic freedom.

Source: Own calculation.

perceived corruption alters, economic freedom is affected. We clarify our attempts to establish identification. Though not the focus of our analysis, we do report in Appendix 3 the results of OLS regressions where economic freedom (for both 2005 and 2009) is the dependent variable and perceived corruption is an explanatory variable, along with our controls. We find that as perceived corruption rises, economic freedom is negatively (and significantly) affected. Higher perceived corruption can imply firms anticipating greater bribery, nepotism, favoritism, and back door activities. These all can stifle competition, damage a healthy business environment, and can lead to greater regulation that in turn will imply lower[8]economic freedom.

[8]We want to point out that these results provide us with an overall idea of the reverse relationship but are not precise. The most up to date data for economic freedom for Indian states is for 2013, which is lagged in terms of the available WBES data for India—2022 wave or 2014 wave. Hopefully, future research can address such questions in a more constructive fashion as more economic freedom data for Indian states become available.

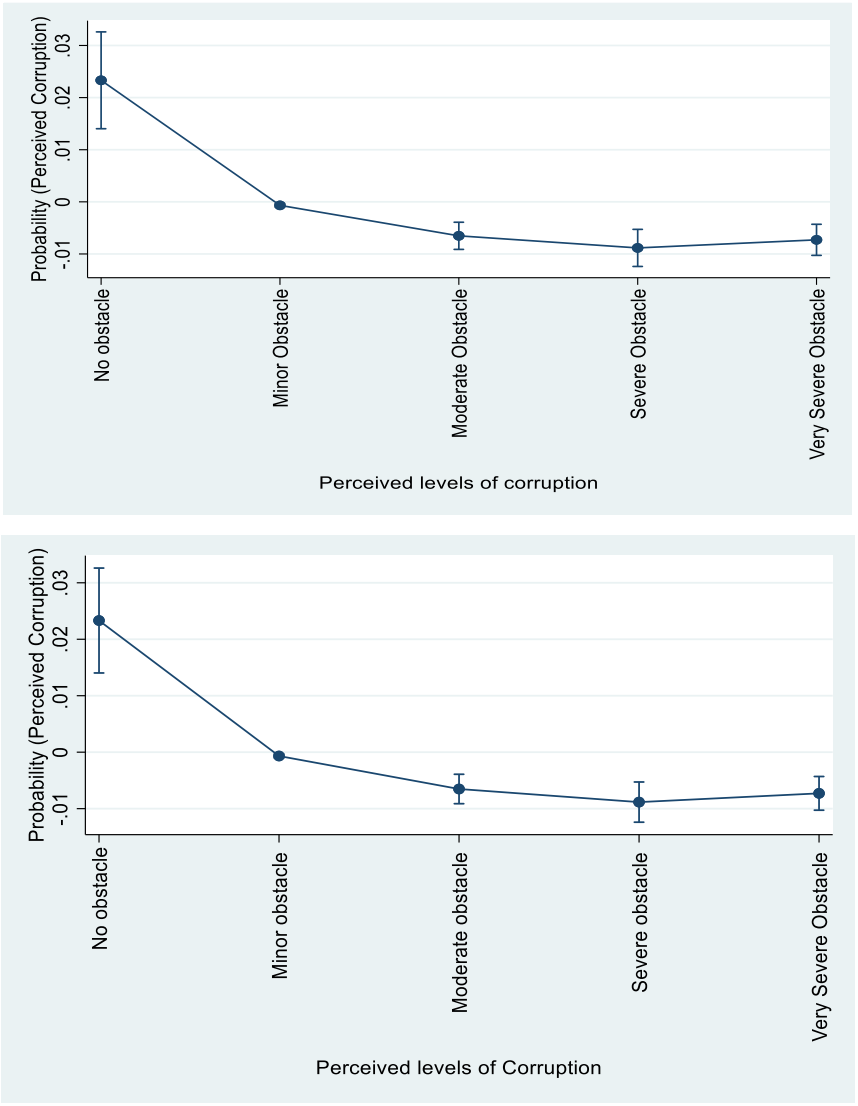


Figure 2. (A and B) Predicted probabilities for perceived levels of corruption for rise in economic freedom. The figures below show the predicted probabilities for firms in terms of perceiving corruption for a rise in economic freedom for the different levels of perceiving corruption. Figure 2A is based on column (4) specification from Table 2 (2005 EF levels), and Figure 2B is based on column (4) specification from Table 3 (2009 EF levels).
Source: Own calculation.

Our variable of interest can also be biased due to not controlling for variables potentially affecting firms' perceived corruption. And, finally, although we consider lagged economic freedom values relative to our dependent variable, there is still the potential of the two being simultaneously determined. Economic freedom and firms' corruption perception being simultaneously determined can lead to sample selection bias. Also, models like logit or probit along with ordered logit or probit impose the same behavioral model on all firm as pointed out by Mallick and Yang (2013). Thus, our main variable of interest—economic freedom—has the potential to suffer from endogeneity arising from reverse causality, omitted variable bias, or sample selection bias.

Instrumental variable (IV) estimation is the recommended method to resolve biases arising out of reverse causality. Yet, such estimation needs efficient instruments that should fulfill the externality conditions. Ideal instruments should be correlated with economic freedom but should not be correlated with firms' corruption perceptions and should be independent of the error term. Available instruments

Table 2. Ordered probit specifications: perceived corruption by firms and economic freedom (2009 values)

	(1)	(2)	(3)	(4)
EF2009	−0.060***	−0.060***	−0.053***	−0.053***
	(0.012)	(0.012)	(0.012)	(0.012)
Medium	–	−0.086***	−0.103***	−0.131***
		(0.031)	(0.031)	(0.032)
Large firm	–	−0.002	−0.041	−0.108***
		(0.031)	(0.031)	(0.032)
Age	–	–	0.006***	0.006***
			(0.0001)	(0.0001)
Percent own	–	–	–	−0.245***
				(0.028)
Observations	8,056	8,056	8,049	8,056
Wald Chi-Sq.	94.57	102.91	157.77	234.86
Marginal effects				
No corruption	0.023*** (0.005)	0.023*** (0.005)	0.020*** (0.005)	0.020*** (0.005)
Minor corruption	−0.001*** (0.0002)	−0.001*** (0.0002)	−0.001*** (0.0002)	−0.0001***(0.0001)
Moderate corruption	−0.007*** (0.001)	−0.007*** (0.001)	−0.006** (0.002)	−0.006*** (0.001)
Severe corruption	−0.009*** (0.002)	−0.009*** (0.002)	−0.008*** (0.002)	−0.008*** (0.002)
Very severe corruption	−0.007*** (0.002)	−0.007*** (0.002)	−0.006*** (0.002)	−0.006*** (0.002)

Ordered Probit Specifications: All firm level data are considered from World Bank Enterprise Surveys 2022 wave. *Corruption* is the dependent variable assessing perceived levels of corruption by the firms. The variable is an ordered dummy variable ranging from 0 to 4 with 0 indicating firms stating, "no perceived corruption," 1 indicating "minor perceived corruption," 2 indicating "moderate perceived corruption," 3 indicating "severe perceived corruption," and 4 representing "very severe perceived corruption." *EF2009final* represents economic freedom for states for the year 2009 considered from Cato Institute database for India. The controls are *firm size* (medium and large with small as the baseline), and *age* of the firm. We control for industry fixed effects. Robust standard errors are reported in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively. We also present the marginal effects for all levels of corruption in the table for a unit rise in economic freedom.

Source: Own calculation.

of economic freedom like "legal origin" (Berggren and Jordahl, 2006) cannot be applied for our study since they vary across countries and not across states or regions within a country. Thus, we are unable to employ external instruments for IV estimation in our analysis. It is well known that, finding credible instruments can be very challenging, and in its absence inefficient instruments can exacerbate inconsistencies for estimates and lead to greater bias compared to ordinary least squares (OLS) estimates (Murray, 2006).

We aim to establish identification by addressing omitted variable bias and sample selection bias. The subsections below elaborate on the methods and the results.

Identification—omitted variable bias

As the first step towards identification, we take into account omitted variable bias. While we control for industry fixed effects, size of firm, age of firm, and extent of firm ownership by the largest owner, there can be other variables that can affect firm's perception of corruption. To ascertain that the coefficient of economic freedom is not picking up the effect of any other variable that can also affect perception of

corruption by firms, we control for an array of additional variables to mitigate the omitted variable bias. The first variable we consider is a dummy assigned 1 if the firm has an existing loan, 0 otherwise. For example, Ongena and Qi (2020) find that when firms are frequently involved in bribery practices, their access to credit tightens. Following this reasoning, having an existing line of credit might enhance perceptions about corruption for firms. Another variable we consider is if the firm has been visited by a tax official in the past year or not. Almost 21 percent of the firms mention that they have been visited by a tax official in the past year. Information on frequency of visits by tax officials in the previous 12 months is also asked as a question in WBES. The variable is a continuous one varying from 1 to 25. We also check our results with this variable since more frequent visits by inspectors might lead to stronger perception about corruption.

Finally, since geography can be linked to perceptions of corruption, we control for firm location—whether the firm is located in the main business city or not. Being in the main business city allows the firm to access appellate bodies or corruption control sources lowering grafts by agencies. Conversely, urban concentration of firms can also be a breeding ground for corruption. As another measure for the spatial dispersion (geography), we consider the size of the city where the firm is located. A dummy is considered for firms located in cities with population more than a million. The final additional variable we consider is the perception of the interviewer about the truthfulness of the responses. A dummy is assigned a value of 1 if the interviewer reports the answers to be truthful, 0 otherwise. A value of 0 can imply somewhat truthful or not truthful.

In Table 3, we present the results with the additional controls. We add the controls one by one in subsequent columns. We consider economic freedom levels for 2009.[9] Our overall results and conclusions remain very similar to our benchmark findings. Economic freedom matters more in lowering the probability of perceiving corruption when firms perceive greater corruption. The probability of perceiving less corruption by firms decreases the most for the column (5) specification when we control for the interviewer's perception of the truthfulness of the answers. Similar to before, we do find that medium and large firms perceive less corruption relative to small firms. In the context of 100 percent ownership of firms by the owners, they do experience marginally higher probability of perceiving less corruption compared to firms who do not have 100 percent firm ownership. For firms having loans, the probability of perceiving corruption goes up for stronger perceived corruption. We present the margin plots in Figure 3 that represent the overall partial derivative similar to our figures before. We consider specification (5) from Table 3 where all controls have been included. The conclusions remain unchanged.

Identification—omitted variable bias—controlling for business climate and actual corruption

Although we have controlled for a wide range of factors in the previous section to mitigate omitted variable bias as much as possible, we need to consider two additional factors that are critical to make sure our main variables of interest are not picking up any other effects. The first variable is a measure of the business climate of the country. Though economic freedom partially captures this effect, given the importance of business climate in the literature in the context of corruption, it becomes vital to control for it separately. As Dutta and Sobel (2016) argue, bribery and corruption can help mitigate private and social deadweight losses that are created by inefficient rules. Productive entrepreneurship can be boosted or sustained via bribery or other forms of corruption in the face of the business climate. In this context, using data for 43 countries from 2003 through 2005, Dreher and Gassebner (2013) find that corruption is beneficial in highly regulated economies (especially when they face requirements such as a high number of procedures needed to start a business and a larger minimum capital requirement). Yet, Dutta and Sobel (2016) find that result is true to the extent that corruption hurts less in the face of a bad business climate. In order to make sure that economic freedom is not picking up the effects of business climate for states, we control for state-level doing business measures for 2019. The variable measures the ease of doing business that encompasses requirements in terms of procedures to start a business,

[9]We check the results with 2005 economic freedom values, and our results remain robust.

Table 3. Ordered probit specifications: perceived corruption by firms and economic freedom (2009 values)—controlling for additional controls

	(1)	(2)	(3)	(4)	(5)
EF2009	−0.029**	−0.034***	−0.277***	−0.041***	−0.096***
	(0.012)	(0.01)	(0.035)	(0.013)	(0.014)
Medium	−0.145***	−0.173***	−0.114	−0.161***	−0.133***
	(0.032)	(0.032)	(0.071)	(0.031)	(0.031)
Large firm	−0.120***	−0.141***	−0.021	−0.139***	−0.143***
	(0.032)	(0.032)	(0.074)	(0.031)	(0.031)
Age	0.005***	0.0057***	0.001	0.004***	0.005***
	(0.0008)	(0.001)	(0.001)	(0.001)	(0.001)
Percent own	−0.215***	−0.163***	−0.241***	−0.115***	−0.063**
	(0.028)	(0.029)	(0.058)	(0.028)	(0.029)
Loan	0.406***	0.302***	0.168**	0.447***	0.400***
	(0.034)	(0.035)	(0.066)	(0.036)	(0.036)
Tax (visit)	–	0.487***	–	0.446***	0.398***
		(0.030)		(0.030)	(0.030)
Frequency (tax visit)	–	–	0.014	–	–
			(0.013)		
Buss. City	–	–	–	−0.004	0.030
				(0.041)	(0.041)
Location (size)	–	–	–	0.537***	0.463***
				(0.027)	(0.027)
Perception (interviewer)	–	–	–	–	0.813***
					(0.036)
Observations	7,951	7,929	1,705	7,929	7,929

Ordered Probit Specifications: All firm level data are considered from World Bank Enterprise Surveys 2022 wave. *Corruption* is the dependent variable assessing perceived levels of corruption by the firms. The variable is an ordered dummy variable ranging from 0 to 4 with 0 indicating firms stating "no perceived corruption," 1 indicating minor perceived corruption, 2 indicating "moderate perceived corruption," 3 indicating "severe perceived corruption," and 4 representing "very severe perceived corruption." Eco Freedom represents economic freedom for states for the year 2009 considered from Cato Institute database for India. Robust standard errors are reported in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively. We control for industry fixed effects in all specifications.

Source: Own calculation.

minimum capital requirements, hiring and firing regulations, steps to step up infrastructure such electricity, etc., amid other factors.

The other variable we consider as an additional control is the actual corruption of states. Our results can suffer from major omitted variable if we do not control for the level of corruption for states. States that are more corrupt are likely to have stronger perceptions about experiencing corruption relative to states experiencing less corruption. We consider corruption data from Transparency Interactional (2019)—the specific variable considered is the percentage of individuals stating that they have paid bribes. The summary statistics for these additional control variables are provided in Appendix 2.

Table 4 presents our results. We consider specification (5) from Table 3 where all additional controls are included and add the mentioned controls in this section. In column (1), we add the doing business variable, and actual corruption is included in the column (2) specification. Both variables are added in column (3). We find that our main variable of interest, economic freedom, retains its sign and

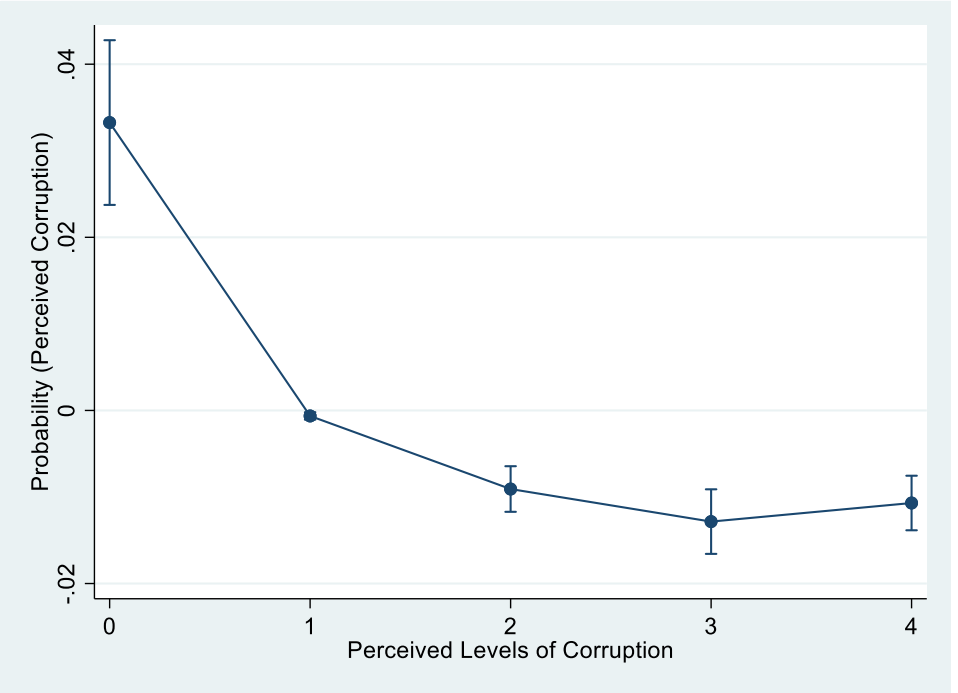


Figure 3. Predicted probabilities for perceived levels of corruption for rise in economic freedom—additional controls. The figures below show the predicted probabilities for firms in terms of perceiving corruption for a rise in economic freedom for the different levels of perceiving corruption. The figure considers column (5) specification from Table 4.
Source: Own calculation.

significance. In Figure 4, we plot the overall partial derivative considering specification (6) from Table 4. Our conclusions remain unchanged.

Idenitification—sample selection bias

As explained earlier, endogeneity can also arise out of sample selection bias arising from economic freedom and corruption perception of firms being co-determined. Though we consider substantially lagged values of economic freedom, the environment and institutional structure shaped by economic freedom in states will simultaneously continue to determine firms' perception of corruption. Further, ordered probit are restrictive models, as mentioned, since they impose the same behavioral model on all firms (Webster and Piesse, 2018). By creating a carefully matched control group via matching techniques, such bias can be mitigated (Borin and Mancini, 2016; Mallick and Yang, 2013).[10]

In an ideal context, we want to observe the same firm in two different situations—being exposed to high economic freedom and at the same time experiencing low economic freedom. A classical solution would be to randomize the treatment but due to costs or ethical issues, treatment status of observational data cannot be randomized (Dutta and Mallick, 2023). This problem can be resolved by creating a counter factual that is similar in all characteristics among treatment and control groups except the specific treatment effect we are interested in—in our case—the extent of economic freedom experienced by firms. Matching techniques help us in creating this counter factual.

[10]The independent variables for the two testable propositions include economic freedom as the main determinant and added to it are a number of covariates or controls for characterizing firms that are covered in this survey. The possible alternative specifications for this set-up may include other variables that the survey captures. Since the purpose is to observe the role of economic freedom on corruption, the present specification is tested for several possible sources of bias including reverse causality and other sources of endogeneity. This is equivalent to examining if alternative specifications (not accounted for here) would retain the original results or not. We have shown with the help of three robustness exercises that the main results continue to hold, which is tantamount to reconsidering the exercise in terms of competing specifications and explanations.

Table 4. Ordered probit specifications: perceived corruption by firms and economic freedom (2009 values)—controlling for business climate and actual corruption

	(1)	(2)	(3)
EF2009	−0.0301*	−0.171***	−0.167***
	(0.015)	(0.015)	(0.016)
Medium	−0.122***	−0.058	−0.059
	(0.032)	(0.036)	(0.036)
Large firm	−0.130***	−0.119***	−0.120***
	(0.033)	(0.036)	(0.036)
Age	0.005***	0.006***	0.00701***
	(0.001)	(0.001)	(0.001)
Percent own	−0.068**	0.009	0.008
	(0.029)	(0.033)	(0.033)
Loan	0.391***	0.421***	0.422***
	(0.037)	(0.039)	(0.039)
Tax (visit)	0.408***	0.461***	0.460***
	(0.030)	(0.034)	(0.034)
Frequency (tax visit)	0.042	−0.094**	−0.093**
	(0.042)	(0.047)	(0.047)
Buss. City	0.433***	0.610***	0.611***
	(0.028)	(0.032)	(0.032)
Location (size)	0.733***	0.726***	0.728***
	(0.037)	(0.043)	(0.044)
Doing business	−0.004***	–	−0.001
	(0.0006)		(0.001)
Corr (actual)	–	−0.767***	−0.708***
		(0.073)	(0.152)
Observations	7,929	6,699	6,699

Ordered Probit Specifications: All firm level data are considered from World Bank Enterprise Surveys 2022 wave. *Corruption* is the dependent variable assessing perceived levels of corruption by the firms. The variable is an ordered dummy variable ranging from 0 to 4 with 0 indicating firms stating "no perceived corruption," 1 indicating minor perceived corruption, 2 indicating "moderate perceived corruption," 3 indicating "severe perceived corruption," and 4 representing "very severe perceived corruption." Eco Freedom represents economic freedom for states for the year 2009 considered from Cato Institute database for India. Robust standard errors are reported in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively. We control for industry fixed effects in all specifications.

Source: Own calculation.

Possible biases can arise if we employ an estimator assessing the effect of the treatment that compares the means of the treated firms (firms experiencing high economic freedom) with untreated firms (firms experiencing low economic freedom). The bias can be from selection on observables or from selection on unobservable variables. The latter bias, termed as omitted variable bias, has been in previous sections. To mitigate the first bias that can be done via matching models, it is important to make sure that no bias from selection on unobservable variables is present and that all treated and untreated observations have shared attributes.

We resort to alternate matching techniques to ensure the robustness of our findings. The popular *propensity score matching* is the first matching technique we implement. The missing potential outcome

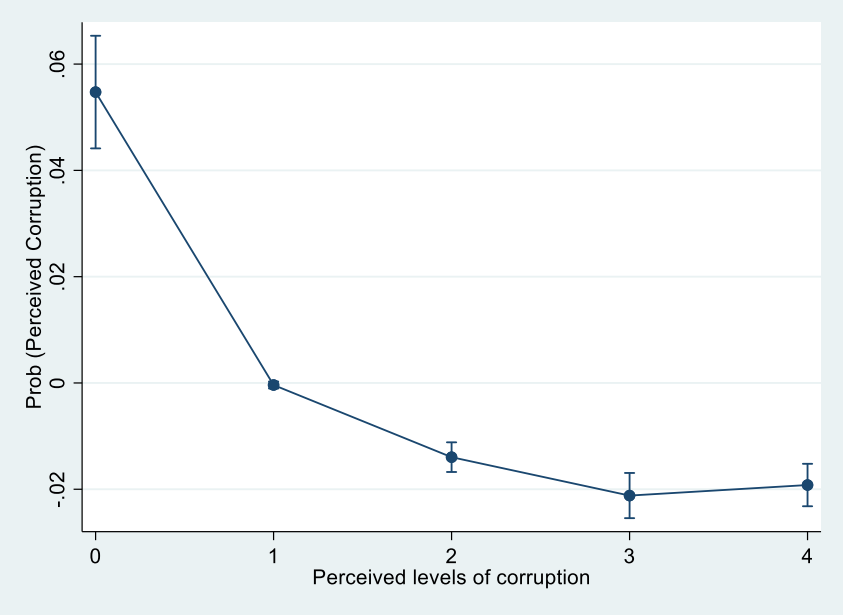


Figure 4. Predicted probabilities for perceived levels of corruption for rise in economic freedom—controlling for business climate and actual corruption. The figures below show the predicted probabilities for firms in terms of perceiving corruption for a rise in economic freedom for the different levels of perceiving corruption. The figure considers column (3) specification from Table 5. Source: Own calculation.

for each country is imputed by using an average of the outcomes of similar firms that receive the treatment. Propensity scores are the estimated treatment probabilities that establish similarity between the firms (STATA, 2023). The computed treatment effect is the average of the difference between the observed and potential outcome for each country. We use both *psmatch* and *psmatch2* commands from STATA to ensure our results are robust.

The second model we consider is the inverse probability weight (IPW) estimator. IPW estimators use weighted averages of the observed variable to estimate means of the potential outcomes (STATA, 2022). For IPW estimators, a two-step approach is used for estimating the desired 'average treatment effects' on the treated group. For the first step, the parameters of the treatment model are estimated followed by estimating the IPWs. In the second step, the weighted averages of the outcomes for each treatment level are computed using the estimated IPWs. The contrasts of these weighted averages provide the estimates of the average treatment effects (ATE) (STATA, 2022). Each weight is the inverse of the estimated probability that a country receives a treatment level. Weights closer to one are received by outcomes of countries who receive a likely treatment. The outcomes of countries who receive an unlikely treatment are assigned weights much larger than one. The advantage of using IPW estimators is that they model the probability of treatment without any assumptions about the functional form for the outcome model. We also describe diagnostic tests associated with the matching models.

Both the dependent and the independent variables need to be binary for these estimators. For corruption, we construct the binary variables based on the sample mean of the ordered dummy variable. The dummy for our dependent variable is assigned 1 if firms perceive more than average corruption, 0 otherwise. For economic freedom, our independent variable, similarly we create a dummy assigned 1 if the state has above average economic freedom scores, 0 otherwise. In Table 5, we present the results. In columns (1) and (2), we present average treatment effects (ATEs) for the propensity score matching model using the commands *psmatch* and *psmatch2*, respectively. In column (3), we present the results for IPW estimates. The results are consistent across the models. For all three models, we find that firms in the treatment group—firms who experience higher than sample average economic freedom—have less perceived corruption. In terms of magnitude, firms in the treatment group perceive about 8 percent less corruption than firms in the control group.

Table 5. Matching models: perceived corruption by firms and economic freedom

	PSM		IPW
	(1)	(2)	(3)
	psmatch - ATE	*psmatch2* - ATE	ATE
EF (treatment)	−0.085***	−0.092***	−0.083***
	(0.011)	(0.017)	(0.010)
Observations	9,254	9,253	9,254

Note 1: In Columns (1) and (2), we report average treatment effects (ATE) employing propensity score matching (PSM) models. We present results for both STATA commands—*psmatch and psmatch2.* In column (3), we report ATE for IPW estimates.
Note 2: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Note 3: The controls included are age of the owner, years of experience of the owner, age of the firm and education level of owner.
Source: Own calculation.

We also run diagnostic tests to make sure that all assumptions with regard to the matching models are valid. In the case of PSM, we consider box plots to make that the distribution of the covariate does not vary over the treatment levels. For assumptions to be not violated for IPW estimates, the estimated plots should not have too much mass around 0 or 1(Busso, DiNardo, and McCrary, 2014). This holds true for our results.

Idenitification—further robustness

As an additional step toward establishing identification, we consider hierarchical probit specifications. Hierarchical models are the preferred models for data that include the hierarchical structure—in our case individual firm level as well as state level data. Also known as multilevel modeling, such estimators are apt in handling individual or group (in our case) state characteristics that can predict the treatment (in our case the extent of economic freedom) (see Gelman, 2007, for example). Further, as Feller and Gelman (2015) point out, hierarchical probit models can also help us to adjust for unmeasured covariates. Finally, such models can go beyond estimating average treatment effect by helping us model the unexplained variance in the same. In Table 6, we recheck our results with hierarchical probit models. We re-run our specifications from Tables (1), (2), and (3) considering the new estimation models. Both economic freedom 2009 and 2005 values are considered. As we can see from the table, our conclusions remain unchanged, with economic freedom having a significantly negative coefficient in all specifications.

Interactions

As mentioned earlier, our second proposition considers the association between economic freedom and corruption perception varying factors such as firm size, extent of ownership by the largest owner, size of locality, and age of firms. We believe the association can be nonlinear based on firm characteristics as well as the location factor. We test the following specification.

$$\text{Corr}(\text{per})_{\text{ijs}} = \alpha_0 + \alpha_1 EF_{\text{js}} + \alpha_2(\text{EF} * \text{factor})_{ijs} + \alpha_3 \text{factor}_{\text{ijs}} + \sum_{\text{k}=1}^{\text{K}} \beta_{\text{k}} \text{X}_{\text{kij}} + \alpha_2 \rho_{\text{i}} + \alpha_3 \theta_{\text{s}} + \epsilon_{\text{ij}} \quad (2)$$

The estimated marginal effect is given by

$$\frac{\partial corr(per)_{ijs}}{\partial EF_{js}} = \alpha_1 + \alpha_2 factor_{ijs} \quad (3)$$

The considered factors are firm size, age, size of locality, and extent of ownership of the largest owner.

Table 6. Hierarchical probit specifications—perceived corruption by firms and economic freedom

	(1)	(2)	(3)	(4)
EF2009	−0.043**	–	−0.106***	–
	(0.016)		(0.022)	
EF2005	–	−0.070***	–	−0.126***
		(0.021)		(0.025)
Medium	−0.056	−0.050	0.040	0.050
	(0.038)	(0.039)	(0.044)	(0.044)
Large firm	−0.017	−0.010	0.035	0.042
	(0.040)	(0.041)	(0.045)	(0.046)
Age	0.007***	0.007***	0.009***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)
Percent own	−0.155***	−0.154***	−0.009	−0.015
	(0.037)	(0.037)	(0.042)	(0.042)
Loan	0.571***	0.568***	0.690***	0.681***
	(0.051)	(0.051)	(0.057)	(0.058)
Tax (visit)	0.334***	0.331***	0.381***	0.373***
	(0.039)	(0.039)	(0.045)	(0.045)
Frequency (tax visit)	0.039	0.033	−0.065	−0.064
	(0.049)	(0.048)	(0.055)	(0.055)
Buss. City	0.383***	0.389***	0.605***	0.601***
	(0.032)	(0.032)	(0.037)	(0.037)
Location (size)	0.902***	0.917***	0.864***	0.866***
	(0.0364)	(0.037)	(0.045)	(0.045)
Doing business	–	–	−0.006***	−0.008***
			(0.001)	(0.001)
Corr (actual)	–	–	−0.300*	−0.251
			(0.161)	(0.155)
Constant	−0.679***	−0.584***	−0.502***	−0.389***
	(0.104)	(0.114)	(0.124)	(0.135)
Observations	7,929	7,929	6,699	6,699
Wald Chi-sq.	1273.87	1276.47***	1427.12***	1429.00***

Hierarchical Probit Specifications: All firm level data are considered from World Bank Enterprise Surveys 2022 wave. *Corruption* is the dependent variable assessing perceived levels of corruption by the firms. The variable is an ordered dummy variable ranging from 0 to 4 with 0 indicating firms stating "no perceived corruption," 1 indicating minor perceived corruption, 2 indicating "moderate perceived corruption," 3 indicating "severe perceived corruption," and 4 representing "very severe perceived corruption." EF represents economic freedom for states for the year 2009 considered from Cato Institute database for India. Robust standard errors are reported in parentheses.***, **, and * denote significance at 1%, 5%, and 10%, respectively. We control for industry fixed effects in all specifications.

Keeping space constraints in mind, we present the margin plots (plots showing the partial derivatives) for all the considered conditioning variables. We remind our readers that to make the analysis simpler, we consider the binary dummy for corruption as our dependent variable that has been considered previously for our matching estimates. The binary dummy for corruption is based on the

dummy being assigned 1 for above average perceived corruption levels based on our sample, and 0 otherwise. Figures 5A and 5B present all the graphs based on the interactions depicting the nonlinear relationship between economic freedom and perceived corruption. The results from the specification are available upon request.

Figure 5A and 5B plot equation (3) for each of the considered factors. In Figure 5A, we consider the dummy for small and non-small firms and interact that with economic freedom. The figure shows how $\frac{\partial corr(per)_{ijs}}{\partial EF_{js}}$ changes in sign and significance for small and all other firms. We find that small firms benefit more in terms of having less perceived corruption when economic freedom rises relative to non-small firms. Also, in Figure 5A (the second part of the figure), we interact firm's age with economic freedom. Again, the idea is to see how $\frac{\partial corr(per)_{ijs}}{\partial EF_{js}}$ changes in sign and significance as the age changes. As evident from the figure, even with a rise in economic freedom, the older the firm gets the probability of perceiving corruption rises.

In Figure 5B, we consider locality size dummy and the 100% ownership dummy. Here, economic freedom is interacted with dummies assigned 1 for firm locations with population greater than 1 million people or if the largest owner owns 100% of the firm. We find that for firms located in million-plus cities compared to smaller cities or towns, greater economic freedom influences less perceived corruption. This is also true for firms when the largest owner owns all the shares of the firm compared to other forms of shareholding. Overall, these results support proposition 2, such that the relationship between economic freedom and corruption differs on the basis of firm characteristics.

Recasting results with panel data

As we mentioned earlier, the data availability in terms of years for waves from WBER and for economic freedom makes the construction of a panel challenging. But to ensure that our results are not sensitive to certain waves, we construct a panel with the 2014 and 2022 waves from WBER. As stated before, these are the only two waves from WBER that asks the question about corruption based on which we construct our dependent variable. The 2005 and 2013 values of economic freedom are used for this panel to maintain a 9-year lag between the dependent variable and the independent variables.

Keeping space constraint in mind, we present the results with the interactions only. The margin plots are presented in Figures 6A and 6B. The margin plots are constructed with the regressions estimates similar to Figures 5A and 5B. The tables with the regression estimates are available on request. As we can see from the figures, our results remain consistent.[11] The results support proposition 2—that the relationship between economic freedom and corruption differs on the basis of firm characteristics.

Conclusion

In this paper, we utilized firm-level survey data for India from athe World Bank Enterprise Survey (WBES). We investigated the relationship between economic freedom and perceived corruption for firms—one that remains elusive generally, and little understood for India. We used the Cato Institute's 'Economic Freedom of the States of India' index (EFSI, 2005, 2009) as our measure of economic freedom at the state-level alongside WBES data for 2022 allowing sufficient time lags for the explanatory variable to address endogeneity concerns. Our results show that a rise in economic freedom results in a significant decrease in perceived corruption for Indian firms. A detailed literature review aids that the present study is the first to establish the proposed relationships for India.

Yet, this contributes to the growing strand of literature reporting a negative relationship between economic freedom and corruption. Additional complexity and qualifications arise when the firms' organizational characteristics are included in a relationship between economic freedom and corruption. Apart from these, we also put to verification the sanctity of responses, because issues regarding

[11]In unreported results, we find differing effects based on a firm's industry. Nonetheless, we have further explored the causal links and find that the results continue to hold with additional controls or interactions. These results are not reported for sake of brevity but are available on request.

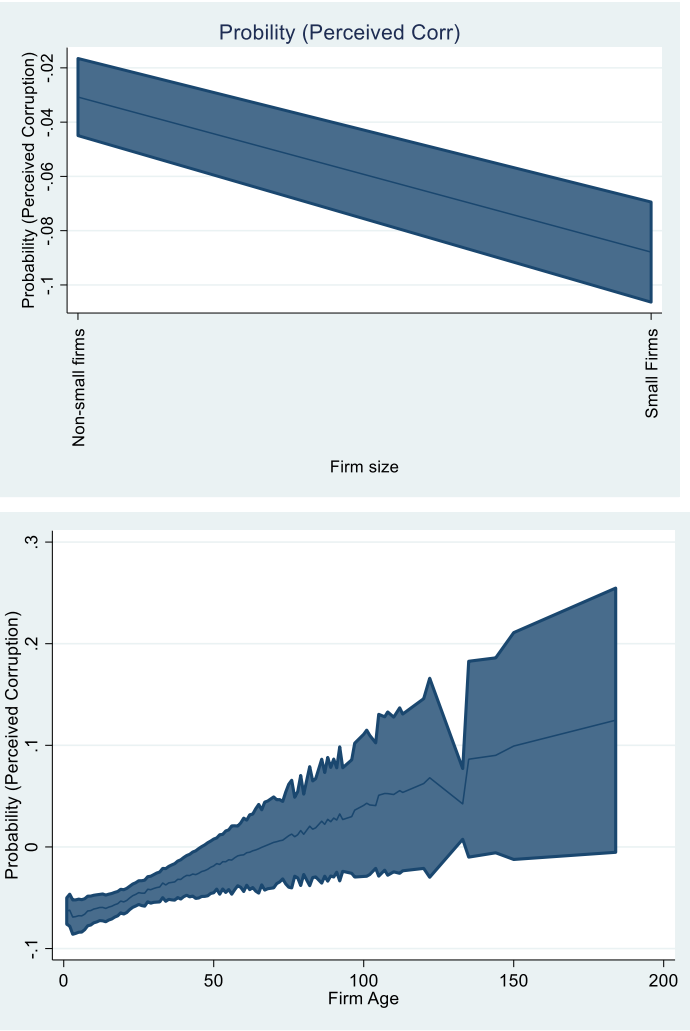
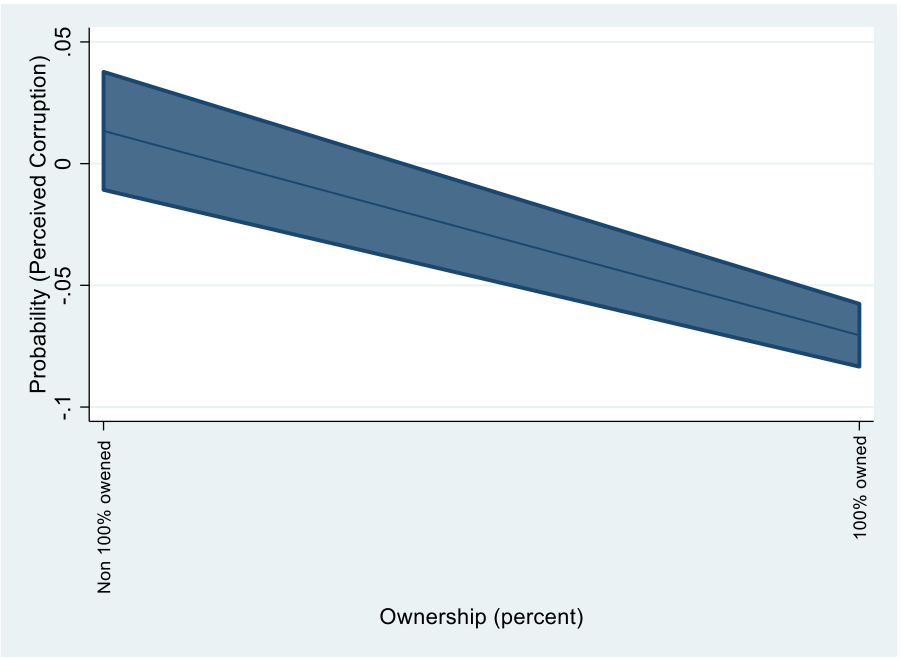


Figure 5A. Marginal effect of economic freedom on perceived corruption based on firm size and age. In the figures below, we plot estimated probabilities based on $\frac{\partial corr(per)_{ijs}}{\partial EF_{js}} = = \alpha_1 + \alpha_2 \text{factor}_{ijs}$ for small firm dummy and age of firms.
Source: Own calculation.

corruption, environmental practices, labor standards, etc. in atypical developing countries are strongly interlaced with political interests. Importantly, we show that when controlling for the interviewer's perception of truthfulness in the interview responses, a much stronger negative relationship is obtained. The subject of bi-directionality and reverse causality only adds to standard problems of omitted variables and misspecification errors in many such empirical exercises. To resolve most of these, we use matching models and control for a large set of variables and show that our results remain meaningful and statistically significant all through. One notable feature is that in India firms that did receive loans and were able to relax their constraint also perceive high corruption.

To comprehend, we investigated how various firm characteristics affect the relationship between economic freedom and perceived corruption. We find a stronger negative relationship for small firms (based on the number of employees) compared to all other firms (medium to very large size). We also find that greater economic freedom results in lesser perceived corruption for younger firms, but *higher* perceived corruption for older firms. This suggests that older and more established firms that have already successfully navigated corruption would not perceive a benefit from improved economic freedom. In fact, exposure to greater firm-level competition usually associated with higher levels of



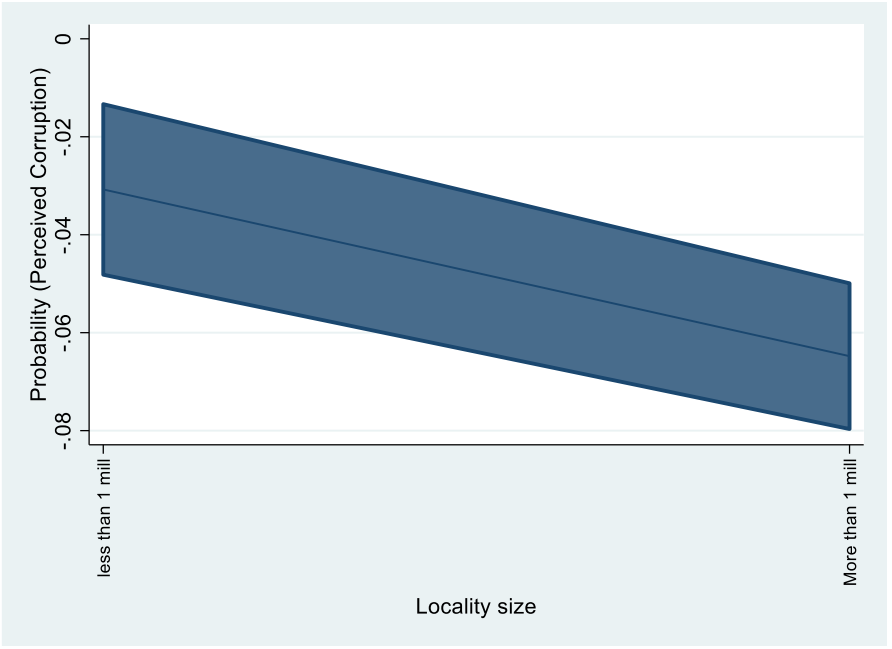


Figure 5B. Marginal effect of economic freedom on perceived corruption based on ownership and locality size. In the figures below, we plot estimated probabilities based on $\frac{\partial corr(per)_{ijs}}{\partial EF_{js}} = = \alpha_1 + \alpha_2 \text{factor}_{ijs}$ for ownership (100 percent versus non 100 percent) and size of locality.
Source: Own calculation.

economic freedom might make older firms vulnerable to predation. This might induce payment of bribes to allow violation of rules, etc. and remain cost competitive. We plan to explore this possibility as a theoretical extension in future.

Further, we find a stronger negative relationship between economic freedom and perceived corruption for firms with sole ownership (compared to joint or multiple-ownership structure) and for firms located in larger cities (compared to smaller cities). These results suggest that, while increased

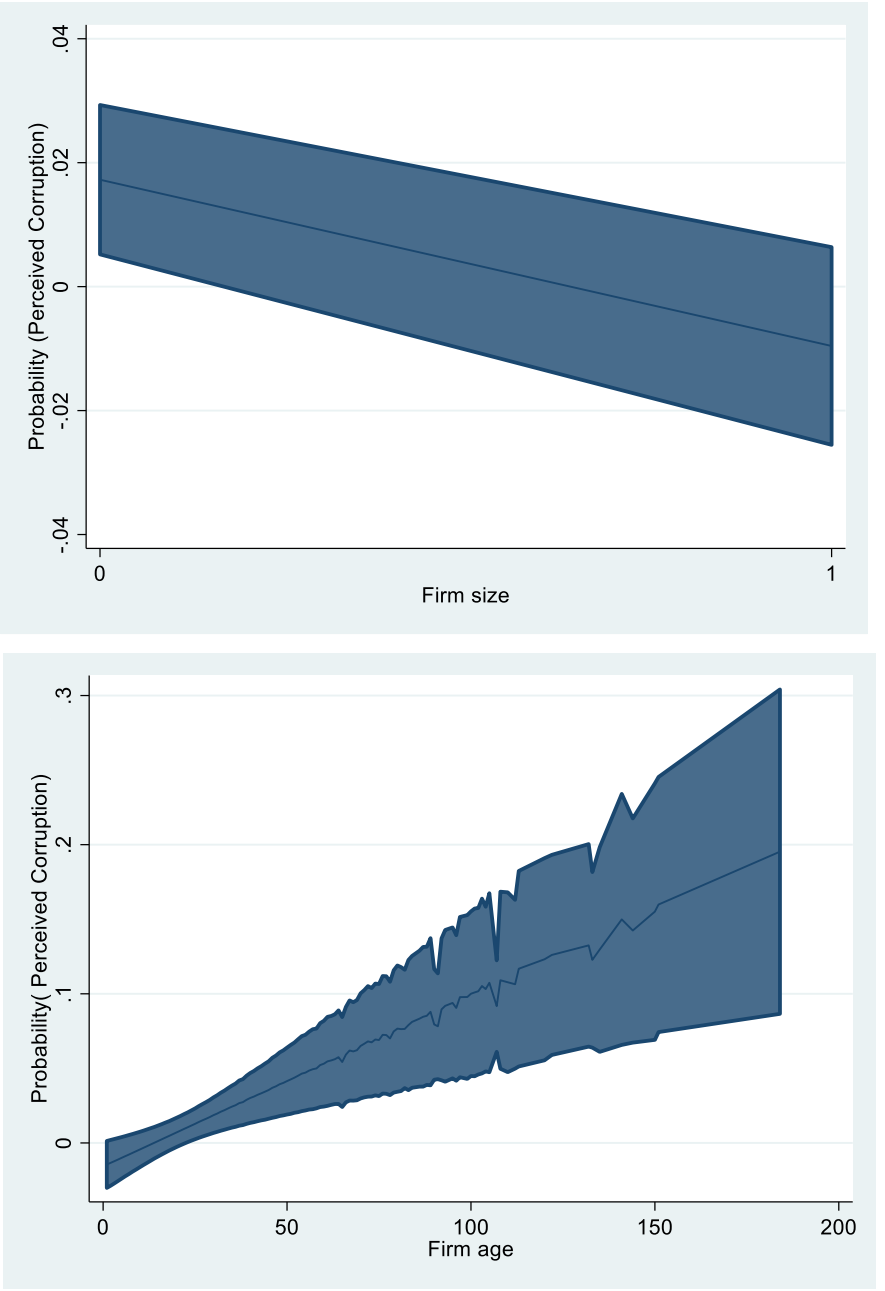


Figure 6A. Panel data—marginal effect of economic freedom on perceived corruption based on firm size and age. In the figures below, we plot estimated probabilities based on $\frac{\partial corr(per)_{ijs}}{\partial EF_{js}} = = \alpha_1 + \alpha_2 \text{factor}_{ijs}$ for small firm dummy and age of firms.

economic freedom results in less perceived corruption for almost all firms, excluding older establishments, the benefits of rising economic freedom will vary by different characteristics of the firms. Future research should consider the possible interaction effects that firm characteristics may have on the relationship between economic freedom and corruption.

For the extended results, we perform multivariate interaction-based regression to examine how economic freedom and corruption correlate based on multiple factors, which is unique to this strand of literature. Overall, our results show that, while economic freedom and corruption indeed appear to be negatively related, the relationship differs based on factors such as firm age, firm size, and ownership.

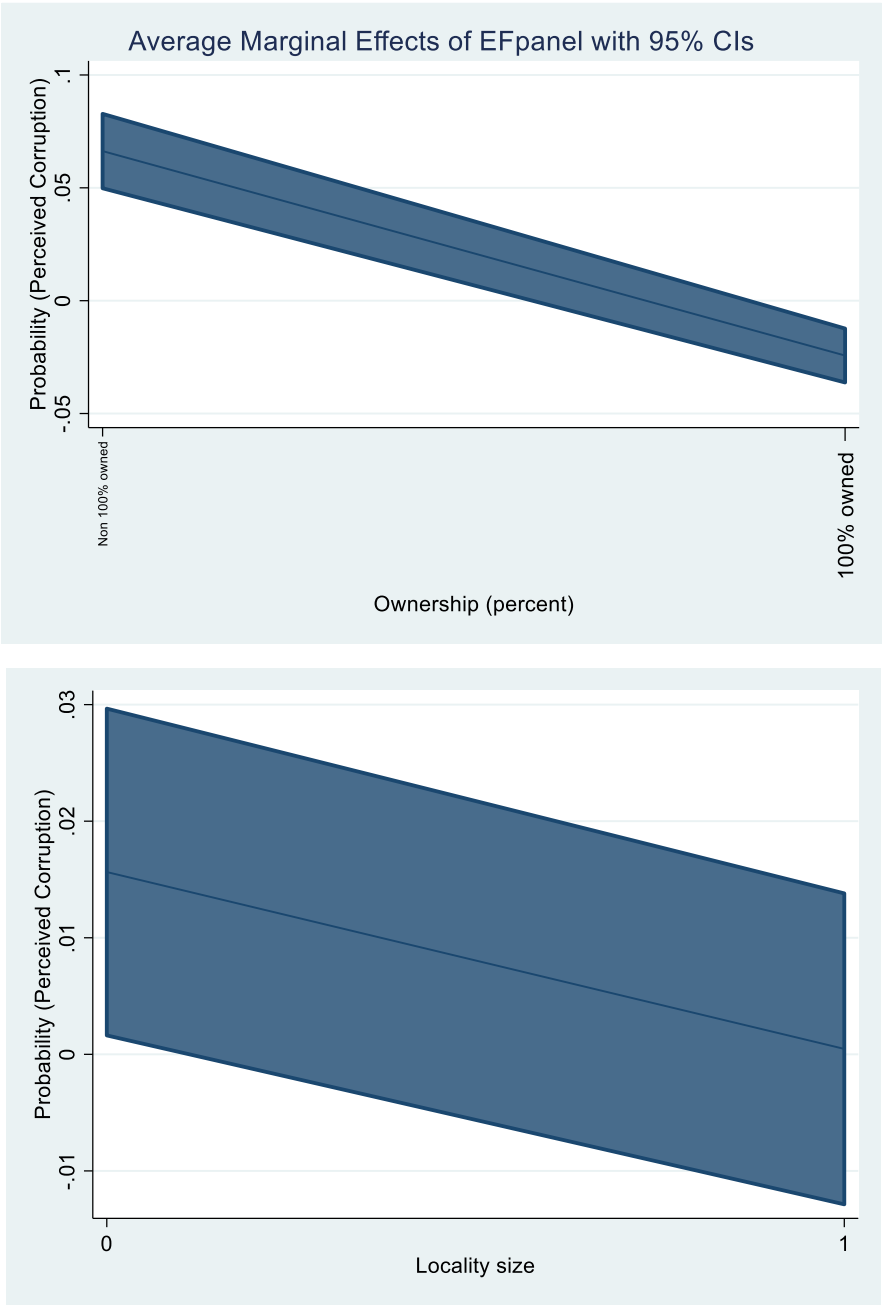


Figure 6B. Panel data—marginal effect of economic freedom on perceived corruption based on ownership and locality size. In the figures below, we plot estimated probabilities based on $\frac{\partial corr(per)_{ijs}}{\partial EF_{js}} = = \alpha_1 + \alpha_2 \text{factor}_{ijs}$ for ownership (100 percent versus non 100 percent) and size of locality.
Source: Own calculation.

In addition, we construct a panel with both corruption perception and economic freedom each with two rounds of data separated by nine years in between. The pooled data continue to generate the same impact for the margin analysis with interaction, as presented briefly in section 7.

Overall, our results may generate certain policy propositions, with an aim to lower corruption by allowing greater economic freedom. Our baseline results do not lend support to the unconventional

argument associated with increased economic freedom—that it raises competition and exposes firms to use bribes as survival strategy. This in itself is revealing and a clear prediction that greater concentration of firms with few large incumbents shall not be conducive to eradication of corruption perception even if economic freedom improves. Since economic freedom does not affect the corruption perception among older firms, and yet the corrupt practices continue to be significant in India, the younger firms must be exposed to a better business environment in order to consider entry and improve the level of competition. Institutional practices need to address these challenges for specific redress.

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Appendix 1. Economic Freedom by States

States	EF 2009	EF 2005
Andhra Pradesh	0.51	0.4
Assam	0.29	0.3
Bihar	0.23	0.25
Chhattisgarh	0.33	0.33
Gujarat	0.57	0.46
Haryana	0.47	0.47
Himachal Pradesh	0.43	0.48
Jammu and Kashmir	0.38	0.34
Jharkhand	0.38	0.4
Karnataka	0.34	0.36
Kerala	0.36	0.38
Madhya Pradesh	0.42	0.49
Maharashtra	0.36	0.4
Odisha	0.31	0.37
Punjab	0.35	0.41
Rajasthan	0.4	0.37
Tamil Nadu	0.59	0.57
Uttar Pradesh	0.34	0.35
Uttarakhand	0.26	0.33
West Bengal	0.33	0.31

Appendix 2. Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Corruption	9,330	1.1	1.3	0	4
EF 2009	8,102	3.9	0.9	2.3	5.9
EF 2005	8,102	3.9	0.7	2.5	5.7
Small firms	9,376	0.3	0.4	0	1
Medium firms	9,376	0.3	0.5	0	1
Large firms	9,376	0.3	0.5	0	1
Age	9,368	22.7	15.1	1	184
Percent own	9,376	0.7	0.4	0	1
Loan	9,262	0.1	0.3	0	1
Tax (visit)	9,340	0.2	0.4	0	1
Freq. (tax visit)	1,955	2.0	1.8	1	25
Buss. City	9,376	0.9	0.3	0	1
Loc. (size).	9,376	0.6	0.5	0	1
Perception	9,376	0.8	0.4	0	1
Doing Buss.	9,127	17.1	24.7	0.1	71.14
Corr. (actual)	7,904	0.2	0.3	0	0.75

Appendix 3. OLS—Economic Freedom and Perceived corruption by firms

	(1)	(2)	(3)	(4)
	EF 2005	EF 2009	EF 2005	EF 2009
Corruption	−0.017***	−0.037***	−0.063***	−0.075***
	(0.005)	(0.006)	(0.006)	(0.007)
Medium	0.070***	0.009	0.092***	0.024
	(0.020)	(0.026)	(0.019)	(0.025)
Large firm	0.173***	0.110***	0.163***	0.099***
	(0.021)	(0.027)	(0.020)	(0.026)
Age	−0.003***	−0.003***	−0.002***	−0.002***
	(0.001)	(0.0001)	(0.001)	(0.001)
Percent own	0.013	0.030	0.036*	0.054**
	(0.019)	(0.024)	(0.018)	(0.024)
Loan	–	–	−0.251***	−0.336***

(*Continued*)

(*Continued*)

	(1)	(2)	(3)	(4)
			(0.019)	(0.029)
Tax (visit)	–	–	0.028	0.067***
			(0.018)	(0.023)
Buss. City	–	–	0.098***	0.282***
			(0.025)	(0.030)
Location (size)	–	–	0.092***	–0.0002
			(0.016)	(0.021)
Perception (interviewer)	–	–	0.490***	0.453***
			(0.020)	(0.026)
Industry F.E.	Yes	Yes	Yes	Yes
	(0.0588)	(0.0712)	(0.0556)	(0.0689)
Constant	3.822***	3.747***	3.378***	3.211***
	(0.037)	(0.045)	(0.045)	(0.056)
Observations	8,049	8,049	7,929	7,929
R-squared	0.027	0.025	0.124	0.091

OLS Specifications: Economic Freedom for the years 2005 and 2009 are the dependent variables considered from Cato Institute database for India. All firm level data are considered from World Bank Enterprise Surveys 2022 wave. *Corruption* is the independent variable assessing perceived levels of corruption by the firms. The variable is an ordered dummy variable ranging from 0 to 4 with 0 indicating firms stating "no perceived corruption," 1 indicating minor perceived corruption, 2 indicating "moderate perceived corruption," 3 indicating "severe perceived corruption," and 4 representing "very severe perceived corruption." Robust standard errors are reported in parentheses. ***, **, and * denote significance at 1%, 5%, and 10%, respectively. We control industry fixed effects in all specifications.

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