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Environmental performance and the role of government support: Evidence from the recent COVID-19 pandemic

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ABSTRACT

This paper investigates whether good firm environmental performance attracted government support. Furthermore, we explore the effect of different government measures such as access to new credit, cash transfers, fiscal exemptions or reductions, and wage subsidies. The COVID-19 data were collected from the COVID-19 follow-up survey, while environmental data are from the World Bank Enterprise Surveys. Our results show that 21% of the firms received wage subsidies, 10% received cash and exemption support and only 6% of firms received credit support. The results indicate that the probability of receiving government support increases if firms have a good environmental performance score.

1. Introduction

Covid-19 represents an unprecedented shock that has significantly influenced a country's economy, individual companies' environmental, social, and governance (ESG)[1] reporting policies and, in particular importance to this study, their environmental performance (EP) (e.g., Albuquerque et al., 2020, Boubaker et al., 2022, He and Harris, 2020). A recent survey reported that governments have provided support to distressed firms mainly as a loan or debt guarantees or equity injectables (OECD, 2021a). For example, Slovakia's wage subsidies safeguard one percent of jobs, or more, during the first wave the of COVID-19 pandemic (Lalinsky and Pál, 2022). These support programs are vital in the short run as it alleviates the broader credit market conditions, decrease the probability of default of viable firms in the long term and increase the economic sustainability of firms. Additionally, many Eastern Europe and Central Asian countries are implementing measures to help the recovery of their economies with the objectives of achieving wider economic advancement and environmental protection (OECD, 2021a). For example, Uzbekistan and Ukraine have incorporated

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[1] The terms Corporate Social Responsibility (CSR) and ESG both fall under the general umbrella of sustainability; however early terminology uses SCR while the latter is ESG. While in some cases CSR and ESG represent slightly different facets of sustainability, much of the research use ESG and CSR interchangeably.

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water-related measures into their COVID-19 responses. While Kazakhstan and some European countries are now providing green support for their MSMEs aligning the COVID-19 recovery program with climate change, biodiversity, and wider environmental protection.

However, it is not clear whether governments in the effort to keep companies afloat and minimize unemployment have considered the companies' environmental performance before providing COVID-19 rescue packages. There is a direct and significant impact of ESG on EP (Wang and Bian, 2022). The predominant view is that companies focusing on EP signal stakeholders their long-term commitments and enhances shareholder value. Moreover, prior to the Covid-19 pandemic, environmental impacts and reducing greenhouse emissions was a particularly popular topic for governments, activists, companies, and academics alike. For instance, the average annual returns of the iShares Global Clean Energy ETF (Ticker: ICLN), an ETF whose portfolio construction embodies the importance of good environmental practice for energy creation, was 22.36% per annum prior to the Covid-19 pandemic. The wider US S&P 500 ETF (Ticker: IVV) had returns of 16.27% over the same time period. Investors found companies that had good environmental practices to be worthy of investment. Following the pandemic this continues to be the case. One stark difference between the climate change push and the impact of the Covid pandemic was that governments provided stimulus packages to reduce the economic impact of the pandemic.

The impact of Covid support packages on financial markets is relatively well known (see, for instance, Phan and Narayan (2020); Topcu and Gulal (2020); Gormsen and Koijen (2020), amongst others). Government support such as financial assistance and loan guarantees ensure the resilience of firms during the pandemic (OECD, 2021a). Although prior studies report that firm-level EP positively impacts access to external finance (Wellalage and Kumar, 2021), it is unclear whether aspects of government support packages favor firms with good EP. The identification of whether receiving government support is enhanced for firms with good EP reaffirms governments' desire to provide a better natural environment. As such, the focus of this study is to investigate whether the government support packages have targeted environmentally friendly firms, thus leading to improving EP.

This research contributes to the literature as follows: First, this is the first research that provides an empirical investigation of the impact of government relief packages on the EP of firms during the COVID-19 pandemic period. Limited studies empirically estimate the effect of government support on firm-level economic stability during the pandemic (Lalinsky and Pál, 2022), nonetheless, firm-level EP is not considered in their analysis. As per the authors understanding this study is pioneering to estimate the firm level of environmental performance and its impact on government financial support when the market experience in negative shocks. Second, the findings of this research will contribute to UN Sustainable Development Goals (SDGs) as governments in the region will be able to implement policies that will lead to lower levels of greenhouse gas emissions by the MSMEs. As a result, leading to higher environmental performance by unlisted firms. The findings will help to ascertain whether government packages focus on achieving the UNSDGs in the short and long term. Third, the findings of this research provide policy direction regarding future government support packages.

2. Literature review

Stimulus packages are governments' method of ensuring that the economy is resilient after a crisis. Governments have responded in various ways to tackle the economic and social impacts of the pandemic (Hale et al., 2020). The Covid-19 pandemic stimulus packages are no different, however, they came at a period when economies were undergoing a structural transformation to net zero emission targets. Leach et al. (2021) highlight the necessity for structural transformations in post-crisis periods and to environmental or climate change as well as to the Covid −19 pandemic.[2] Markets have evolved to these new expectations with ESG ratings being the method in which firms are evaluated. The intersection of the pandemic and the climate change movement provides an excellent setting to investigate whether firms with better environmental performance were preferred in receiving pandemic relief packages. To the best of our knowledge there exist no studies that investigate this relationship in a context similar to this.

As such, two main areas of prior studies inform our research, namely the impact of ESG on firm performance and the impact of environmental policies. We start with the impact of ESG on firm performance. Prior research has linked ESG to proactive environmental practices. According to Anser et al. (2020) and Awan et al. (2022), ESG and EP can be seen as complementary when it comes to understanding assumptions about the role of corporations and the relationship between organizations and the environment. This area of research is broad; however, it does provide guidance for firms' movement toward better ESG procedures. From the perspective of the cost of finance for firms, the research highlights that firms with higher ESG scores have lower costs of debt and equity have higher credit ratings (see, for instance, El Ghoul et al. 2011; Chava, 2014; Attig et al., 2013, Jiraporn et al., 2014).

Another facet of the impact of good ESG practices is on firm-level risk. Godfrey et al. (2009) and Muhammad et al. (2015) show that good ESG practices have also contributed to lower firm-level risk. Similar outcomes are found for the relationships between risk and community and environmental components of social performance (Salama et al., 2011), environmental concerns and risk (Oikonomou et al., 2012) and the environmental component of ESG practices on risk (Bouslah et al., 2013).[3] Firm ESG practices influence firm risk

[2] There is an extensive body of literature on structural transformations investigating various aspects from the transition from low productivity agriculture or manufacturing to rural to urban migration. There is however little empirical research into the structural transformation from polluting to clean, ESG driven societies.

[3] Bouslah et al. (2013) find that, for S&P500 firms, the environment component positively affects firm risk while for non-S&P500 firms, the environment component negatively affects firm risk. There is therefore some doubt regarding the impact of environmental practices, though this difference may be because of media or analyst coverage in larger stocks in the US.

with better practices reducing this risk as the costs can be extensive and damage corporate reputation for non-compliance of the firm's objectives with ESG.

Other ESG facets can also influence the various issues raised above, namely firms' ability to draw upon funds, financial markets' access, leverage, or loan conditions. Cheng et al. (2014) for instance show that firms with better ESG performance face lower capital constraints, because of superior stakeholder engagement and transparency/accountability. Furthermore, good ESG practices lead to lower financial distress risk (Boubaker et al., 2020). This may be a result of better access to the financial market (Jo and Na, 2012). Furthermore, firms with better environmental practices have higher leverage which allows them to increase their potential tax benefit of debt financing (Sharfman and Fernando, 2008). Lastly, Goss and Roberts (2011) show that firms that display ESG concerns result in banks providing less attractive loan contract terms.

The aforementioned studies document that good ESG practices are generally good for firms for a variety of reasons which usually relate to risk or perception in the market. Of particular note, which stands out in this review is the impact of good environmental performance, with this facet of ESG being viewed by stakeholders as particularly beneficial, especially from a financial perspective. However, empirical studies relating to the performance of firms that have received government support, especially around crises, are scant. The lack of empirical research into governmental support is due to the lack of crises of this nature, or scale.

The second relevant body of literature is focused on the impact of governmental policies, specifically environmental policies. A prior crisis similar in nature was the global financial crisis (GFC) and therefore most of the literature on the impact of a broad stimulus package discusses the troubled asset relief program (TARP), which was rolled out during the GFC. At the time of writing, there are a few studies investigating the impact of the COVID-19 crisis. Berger and Roman (2020) take a broad lens and provide a discourse on the prior literature within this area covering bank bailouts, bail-ins, and other resolution approaches to a range of financial crises. Other studies take a more focused stance and investigate the main US assistance program – the paycheck protection program (PPP). For instance, Balyuk et al. (2020) investigate the impact of this scheme on small businesses and find that these firms appear reluctant to take PPP funds. The authors put this reluctance down to a perception of larger indirect costs for the firm resulting from additional scrutiny of PPP recipients and the targeting of public firms.

The impact of environmental policies, in general, is not well understood, especially in relation to emerging areas like climate change or emission reduction. Retrospective policy evaluation is difficult due to a number of reasons such as the complexity of the interactions of market forces with innovation and increased understanding of environmental impacts (Taylor, 2008). Taylor notwithstanding, a body of literature has been built investigating the impact of policy on financial performance. Guo et al. (2020) investigate these impacts on heavily polluting firms and, as expected, find that more stringent policies have a larger negative stock market reaction. Similarly, Pham et al. (2023) find that the impact of policy depends on whether the policy is tightening or loosening and the green stock market subgroups. While in early research Ramiah et al. (2013) showed that the Australian market is particularly sensitive to environmental policy announcements.

Countries around the world have, to some degree, provided relief to citizens via several different forms. The variety of these relief methods is dependent on the country implementing them, for example, individual tax relief, business tax credits, or tax cuts for individuals or businesses. Additionally, governments have brought forward strategies to stimulate the post-pandemic economic recovery in order to provide the economy with enough stimulus to avoid the detrimental aspects of job losses or recessions. However, these relief packages are often unrelated to environmental goals which were a priority prior to the covid outbreak. Indeed, government relief packages are often at odds with environmental goals (OECD, 2021b).

As observed there exists little research into government relief packages, in general, and only peripheral studies that investigate Covid-19 related relief packages. To the best of our knowledge, there exists no study that investigates the impact of government relief packages, in any country, on EP. To this extent, whether government subsidies target firms that are environmentally friendly or subsidies are provided to firms with strings attached so that it leads to improving the firms' EP, is relatively unexplored in the literature. By examining government assistance packages given to firms in 23 countries in Eastern Europe and Central Asia during the COVID-19 pandemic (N = 12,986), our study aims to bridge the knowledge gap and focus on two different aspects of financing: liquidity and access to bank financing. The reason for choosing these countries is that they have provided both firm EP and COVID-19 data.

Based on the above discussion, we propose our hypothesis as follows:

Hi: Government support packages are positively related to the firm environmental performance.

3. Data and variables

Data for this study come from the COVID-19 follow-up survey (CEFS) from Enterprise Survey-2020/2021 and Environmental data are assembled from the World Bank Enterprise Surveys (WBES) in Eastern Europe and Central Asia countries (WBES) in 2019. Using a unique ID, we merge the two datasets. Table 1 presents our sample.

Our main dependent variable, GV (*Gov_support*), takes the value of one if the firm received any support from the government or expects to receive it within 3 months (ie., the firm is already in the process of obtaining government support), and zero otherwise. Government support/funding availability (either immediately or within 3 months) helps unlisted firms to cover emergency expenses, fill gaps in cash flows, buy inventory, or take advantage of business opportunities during the crisis period. We further, explore the effect of different GV such as access to new credit (*Credit_support*), cash transfers for business, (*Cash_support*), fiscal exemptions, or reductions

Table 1
Country distribution.

Country	Firms	Percentage	Micro	Small	Medium	Large	Stringency Index
Albania	365	2.83	8	155	105	97	37.96
Azerbaijan	197	1.53	0	93	60	44	61.11
Belarus	588	4.56	11	276	182	119	43.52
Bosnia	331	2.57	9	138	107	77	35.19
Croatia	331	2.57	5	139	122	65	33.8
Cyprus	242	1.88	16	100	75	51	40.74
Czech	461	3.58	2	212	150	97	37.04
Estonia	337	2.61	3	146	112	76	23.15
Georgia	566	4.39	16	260	177	113	64.81
Greece	549	4.26	3	213	202	131	48.61
Hungary	783	6.07	8	331	261	183	27.78
Italy	725	5.62	0	317	241	167	50.00
Kazakhstan	1412	10.96	2	663	477	270	62.96
Latvia	347	2.69	21	128	131	67	41.67
Lithuania	243	1.89	5	151	10	77	29.63
Moldova	366	2.84	22	162	107	75	51.85
Montenegro	1164	9.03	10	73	51	21	NA
Poland	1022	7.93	6	489	412	257	38.89
Portugal	755	5.86	0	383	383	256	58.33
Romania	1219	9.46	0	369	249	137	38.43
Russia	360	2.79	0	579	398	242	46.76
Serbia	371	2.88	14	149	117	80	36.11
Slovenia	155	1.2	0	163	136	72	29.63
Total	**12,889**	**100**	**161**	**5689**	**4265**	**2774**	

$N = 12{,}889$: (a) Micro firms = 161; Small firms = 5689; Medium firms = 4265, and Large firms= 2774 from 23 countries. Government Response Stringency Index (0 to 100, 100 = strictest).

(*Excemp_support*), and wage subsidies (*Wage_support*). Our main explanatory variable is the environmental index (*ei*). Using Principal Components Analysis (PCA) we create an environmental index (see Nicoletti et al., 1999). The environmental index provides information about the relative value of EP between the sample firms. Appendix 1 shows the PCA analysed results of the 10 environmental factors. Three principal components were retained, and they explained 60% of the total variance of the data. The higher the index is, the better the EP of the firm.

Firms with good environmental performance tend to have lower firm risk (and positive attributions from stakeholders (Godfrey et al., 2009). Further, using Eastern Europe and Central Asian firms Welalage et al. (2021) report that a firm's environmental performance reduces the adverse effects of COVID-19. Hence, firms with a high environmental performance increase their viability when markets and institutions experience a negative shock. When offering government support, it is essential to identify viable businesses although they are vulnerable during COVID-19 (Freund and Pesme, 2021). Thus, we assume that firm-level environmental performance has a positive impact on the level of government support.

We further include firm size variables (Micro, Small, Medium, Large), industry variables (Manufacturing, Retail, Services), legal ownership (sole proprietorship or not), female ownership (*Female_Own*), and firm-level innovation (innovative firms or not) in our model.

Table 2
Descriptive Statistics.

Variable	Obs	Mean	Median	Std. Dev	Minimum	Maximum
Gov_Support	12,986	0.2797	0	0.4488	0	1
Cash_Support	12,986	0.0999	0	0.2998	0	1
Credit_Support	12,986	0.0565	0	0.2309	0	1
ei	12,986	0.000		1.7320	−1.3520	2.219
Excemp_Support	12,986	0.1024	0	0.3032	0	1
Wage_Support	12,986	0.2108	0	0.4079	0	1
Manufacturing	12,986	0.5458	−1.351	0.4979	0	1
Retail	12,986	0.1754	1	0.3803	0	1
Services	12,986	0.2786	0	0.4483	0	1
Micro	12,986	0.0122	0	0.1096	0	1
Small	12,986	0.4383	0	0.4962	0	1
Medium	12,986	0.3366	0	0.4725	0	1
Large	12,986	0.2127	0	0.4092	0	1
Innovation	12,986	0.3811	0	0.4856	0	1
Female_Own	12,986	0.3552	0	0.4786	0	1
Sole_Prop	12,986	0.1433	0	0.3504	0	1

Table 2 reports sample statistics. Approximately 28% of firms received GV during the COVID-19 pandemic, in the form of wage support (21%), and cash and exemption support (10%). Only 6% of firms received credit support. The environment index (*ei*) ranges between −1.352 and 2.219, suggesting a significant disparity regarding ESG and environmental matters.

4. Methodology

We use an extended regression model (ERM), to handle common econometric biases, such as endogeneity, sample selection and treatment effect. Endogeneity between GP and GV may arise in three ways (e.g., Shahab et al., 2018; Wen et al., 2016): omitted variable, measurement errors, and simultaneity, and simultaneity. To address these endogeneity biases, we use the locality-industry sector average of the EP index (*avg_ei*). For instance, some industries have performed well ahead of others in terms of environmentally friendly practices (Hoepner and Yu, 2010). The literature also reports that a locality-industry average instrument variable eliminates the unobservable biases at the firm level (Qi and Ongena, 2020; Wellalage and Thrikawala, 2021; Wellalage and Kumar, 2021). Nevertheless, we acknowledge the limitation of the industry averages as an instrumental variable that may not fully capture the firm-specific effects of environmental performance. Economically, we checked our instrumental variable validity using F-test for joint significance. The F-test for joint significance exceeds the value10 which gives us confidence to use the locality-industry average as an instrumental variable in this regression.

We try to reduce sample selection biases in our sample as limited information in a non-random subsample of the population of participants may lead to sample selection biases (Bushway et al., 2007). GV is observed only for firms who applied for GV because they experienced a decline in sales during the COVID-19 outbreak (Hewa Wellalage and Thrikawala, 2021). Below is our equation, considering the selection of firms, which report that GV is required due to their sales decrease in the COVID-19 outbreak. The *i* variable takes a value of 1 if the firm decreases sales in the COVID-19 outbreak or zero otherwise.

To address selection bias, we use (*temp_closed*) as the selection variable. The variable *temp_closed* takes the value of one if the firm reports that it has temporarily closed during the COVID-19 pandemic, and zero otherwise. From a firm's perspective, a temporary closure is exogenous and plausibly random. The closures are likely to cause temporary reductions in available liquidity, hence being able to be used in this model (Gorodnichenko and Schnitzer, 2013). Thus *temp_closed* indicates fewer sales which, in turn, infers a need for GV. However, the exogenous, and plausibly random, nature of this event makes *temp_closed* unlikely to directly affect a firm's access to GV support. Accordingly, our selected variable is valid.

Based on the above discussion, we formulate the following extended probit (eprobit) regression:

$$\begin{aligned} &Gov\_Support_{\ i} = \beta_0 + \beta_1\ ei_{\ i} + \beta_2(Firmcharacteristics)_i + \beta_3\ industry_{\ i} + \gamma_s + \ Error_{\ 1i} \\ &endogenous\colon e_i = f\left(Avg_{ei_i}\right) + \ Error_{\ 2i} \\ &end.selection : Probit\ (\ Sales\_Decrese_{\ i} = 1) = \alpha_c + (\alpha + \beta ei_i + \gamma X_i + \partial_1\ temp_{\ closed\ i}) + \varepsilon_i \end{aligned} \tag{1}$$

5. Results

Table 3 reports our main results. At the bottom of the table, the significant correlation estimates indicate that we reject the null hypotheses of no endogenous covariates and no endogenous selection biases. The *Gov_Support* equation (column (1) of Table 3) provides the coefficient estimates for Eq. [1], after controlling for endogenous covariates and selection biases. Additionally, the $Sales\_Decrease_i$ and ei_i equations signified in bold in Table 3, provide the coefficient estimates for the auxiliary selection assignment and endogenous covariate equations, respectively. The *ei* variable is positively and significantly (β=0.0518) correlated with GV, indicating that higher firm-level EP is beneficial in regard to obtaining GV in the COVID-19 pandemic. This finding aligns with the argument that environmental performance is regarded as more trustworthy by external stakeholders, who are likely to place a premium on such firms even if overall market trust is low (Lins et al., 2017). In addition, we can argue that environmental performance creates moral capital, which provides insurance-like protection to stakeholders (Godfrey et al., 2009), promotes corporate image (Branco and Rodrigues, 2006) and increases access to crucial resources (Zeidan et al., 2015), in this case, government funds. Nevertheless, studies that follow the lens of agency theory provide an oppositive view that environmental investments are costly diversions of scarce resources, generate lower market competitiveness and reduce short-term profitability (Friedman, 1970), especially when the business environment is hostile (Martínez et al., 2016).

Our results also indicate that, across all countries, there is no difference in the ability to obtain funding between micro, small, medium, or large firms. This result is an important facet of the relief programs such that they cover all areas of the economy and are not obtainable for only the large, well-resourced firms. We note that manufacturing and retail firms have relatively easy access to all types of government funding. Of note, if the firm is a sole proprietor, it is more likely that it can access all types of funding except for credit support. Additionally, if the firm is classified as innovative, then there is a higher likelihood that it will obtain government funding in the form of GV as well as wage support, however, it will be less likely to receive support in the form of cash or credit support or fiscal relief. For sole proprietors or innovating firms, the lower likelihood of obtaining the highlighted forms of support or relief is likely to be due to the structure of the company or the way they do business. We leave the investigation of which forms of GV are more useful to these types of firms to future research.

Table 4 reports the margins (probabilities) to obtain interpretable effects, as the relationship between the environmental index (ei) and GV may vary across the level of ei. Additionally, such margins capture all the non-linearities involved in Eq. [1] (Wellalage et al.,

Table 3
Government support and environmental performance.

	Gov_Support (1)	Cash_Support (2)	Credit_Support (3)	Excemp_Support (4)	Wage_Support (5)
Panel A: Main Equation					
ei1	.0518**	.0632**	.0197	.0317	.0301*
	(0.0177)	(0.0226)	(0.0262)	(0.0216)	(0.0173)
Industry Manufacturing	4.369***	3.659***	2.999***	3.648***	4.088***
	(0.1982)	(0.1782)	(0.1932)	(0.2464)	(0.2978)
Retail	4.377***	3.662***	2.882***	3.582***	4.075***
	(0.2254)	(0.1904)	(0.1965)	(0.1923)	(0.2889)
Firm Size Small	.1645	.4056**	.1633	.2018	−0.0669
	(0.1234)	(1707)	(0.1951)	(0.1575)	(0.1178)
Medium	.1482	.2340	.1654	.2012	−0.0566
	(0.1241)	(0.1719)	(0.1962)	(0.1584)	(0.1185)
Large	.1088	.1934	.2322	.2212	−0.0374
	(0.1254)	(0.1737)	(0.1979)	(0.1600)	(0.1198)
Sole_Prop	.5142***	.4005***	.0761	.3314***	.3667***
	(0.0386)	(0.0443)	(0.0554)	(0.0433)	(0.0372)
Innovation	.0869***	−0.1423***	−0.1036*	−0.1220***	.1168***
	(0.0274)	(0.0355)	(0.0409)	(0.0339)	(0.0269)
Female_Own	.0448	.0980**	.1109**	.0467	.0510*
	(0.0279)	(0.0351)	(0.0400)	(0.0336)	(0.0274)
sales_dec	.7490***	.1186	.6613***	.7817***	1.082***
	(0.0914)	(0.1208)	(0.1246)	(0.1015)	(0.0717)
Country dummies	Yes	Yes	Yes	Yes	Yes
Cons	−5.371***	−5.175***	−4.970***	−5.372***	−5.311
	(0.2289)	(0.2559)	(0.2651)	(0.5826)	(0.2937)
Panel B: sales_dec					
temp_close	.7627***	.7604***	.7606***	.7604***	.7654***
	(0.0305)	(0.0306)	(0.0309)	(0.0306)	(0.0303)
Cons	.0029	.0018	.0018	.0018	.0027
	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0160)
ei1					
avg_ei1	1.005***	1.005***	1.005***	1.004***	1.004***
	(0.0149)	(0.0149)	(0.0149)	(0.0149)	(0.0149)
Cons	.0054	.0054	.0054	.0054	−0.0054
	(0.0165)	(0.0165)	(0.0165)	(0.0165)	(0.0165)
var(e.ei1)	2.447	2.447	2.447	2.447	2.447
	(0.0223)	(0.0223)	(0.0223)	(0.0223)	(0.0223)
corr(e.sales_dec, e.gov_support)	−0.2872***	−0.2076***	−0.2798***	−0.3603***	−0.5017***
	(0.0610)	(0.0773)	(0.0812)	(0.0669)	(0.0502)
corr(e.ei1, e.gov_support)	−0.0445*	−0.0763**	.0048	−0.0361	.2004**
	(0.0308)	(0.0392)	(0.0447)	(0.0376)	(0.0303)
corr(e.ei1, e.sales_dec_covid)	−0.2009***	−0.2008***	−0.2008***	−0.2120***	−0.2170***
	(0.0137)	(0.0137)	(0.0137)	(0.0137)	(0.0137)

Table 3 reports eprobit results with endogenous covariate and selection bias for environmental performance. Column 1 reports regression results for government support (*Gov_Support*) as the dependent variable. Columns 2, 3, 4 and 5 reports cash support (*Cash_Support*), Credit support (*Credit_Support*) Exemption support (*Exemp_Support*), and wage support (*Wage_Support*) as dependent variables, respectively. The base group for firm size is micro firms (less than 5 employees) and the base group for the industry is services. Standard errors are in parentheses. * Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

2020). In particular, the probability of GV ranges from 36.07%, when the environment index, for firms, is reported at its minimum level, to 42.98% when the environment index is at its maximum level. In regard to the types of GV, the environment index shows the lowest impact for credit support (i.e., the probability of credit support ranges from 7.10% when the environment index is reported at its minimum level, to 8.09%, when the environment index is at its maximum level). Without any surprises, Table 3, Panel B indicates that the environment index has the highest impact on wage support (i.e., the probability of wage support ranges from 27.75% when the environment index is reported at its minimum level, to 31.58%, when the environment index is at its maximum level. This result indicates that government wage support is provided to firms that have evidence of engaging in EP activities.

6. Subsample analysis and robustness

This study reports a subsample analysis based on three criteria. Table 5, Panel A reports the subsample analysis based on geographic locations. Although the *ei* variable positively and significantly impacts on the GV variable in the Eastern Europe group, it does not significantly impact on Central Asia group. These results indicate that higher firm-level EP is beneficial only for Eastern European countries regarding obtaining government support during the COVID-19 pandemic. Table 5, Panel B reports the subsample analysis based on the World Governance Indicator (WGI). High WGI groups indicate that higher firm-level EO positively impacts obtaining

Table 4
Predictive margins for government support and environmental performance ($N = 8935$).

At	Gov_Suport (1)	Cash_Support (2)	Credit_Support (3)	Excemp_support (4)	Wage_Support (5)
1	.3607***	.1179***	.0710***	.1300**	.2775***
	(0.0429)	(0.0063)	(0.0091)	(0.0664)	(0.0334)
2	.3703***	.1241***	.0723***	.1335**	.2828***
	(0.0427)	(0.0047)	(0.0082)	(0.0674)	(0.0330)
3	.3801***	.1305***	.0737***	1370**	.2882***
	(0427)	(0.0036)	(0.0078)	(0.0685)	(0.0329)
4	.3898***	.1372***	.0751***	.1406**	.2936***
	(0.0430)	(0.0037)	(0.0078)	(0.0697)	(0.0331)
5	.3998***	.1441***	.0765***	.1442**	.2991***
	(0435)	(0.0052)	(0.0082)	(0.0710)	(0.0336)
6	.4097***	.1512***	.0780***	.1479**	.3046***
	(0.0442)	(0.0074)	(0.0090)	(0724)	(0.0344)
7	.4197***	1585***	.0794***	.1517**	.3102***
	(0.0452)	(0.0100)	(0.0102)	(0.0739)	(0.0354)
8	.4298***	.1661***	.0809***	.1555**	.3158***
	(0.0464)	(0.0129)	(0.0117)	(0.0754)	(0.0367)

1.at: ei = −1.3515; 2.at: ei = −0.8515; 3.at: ei = −0.3515; 4.at: ei = 0.1484; 5.at: ei = 0.6484; 6.at: ei = 1.1484; 7.at: ei = 1.6484; 8.at: ei =2.1484.
Delta-method standard errors are in parentheses. * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.

government support. However, firm-level EP activities do not significantly impact countries with low WGI.

As a robustness test, we include additional variables (Geographic location, World Governance Indicator value, and bank leverage) and rerun the regression. The coefficients of *ei* variable is β=0.0417**, β=0.0614**, β=0.0128, β=0.0289, β=0.0186* in *ei and GOV_Support, Cash_Support, Credit_Support, Excemp_ Support and Wage_Support nexus.* The coefficients confirm our main results.[4]

7. Conclusion

This paper presents empirical results on the relationship between firm EP, measured as an environmental index, and GV resulting from the Covid-19 pandemic. We further expand this analysis to capture different types of support, namely access to new credit, cash transfers for business, fiscal exemptions or reductions, and wage subsidies. We conduct an eprobit regression model to identify this relationship. Generally, we find a strong relationship linking a firm's EP, measured by the environmental index, and the propensity to obtain GV. This relationship extends to support for cash transfers and wage subsidies. We do not find significant results indicating that good EP results in a higher likelihood of receiving support in the form of new credit or fiscal exemptions. Importantly, not only do we find that EP is correlated with a higher propensity to obtain GV but also that there is a benefit to having higher EP – an increased likelihood of obtaining GV at a marginal level.

The policy implications of this research are significant. First, our research highlights that GV during the Covid-19 pandemic is not being subverted to support firms with low EP. While firms from all industries, including firms from traditionally less environmentally sectors, are able to access GV, our results indicate that the packages provided by countries around the world are maintaining their pre-Covid emphasis on environmentally progressive actions. Second, while there is evidence of an environmentally friendly benefit, governments can better tailor support programs to emphasize environmental outcomes not only to continue to support businesses during this pandemic but also to plan for future pandemics or events that require GV. Third, promoting the use of voluntary approaches to achieve environmental improvements in unlisted firms is also important. This includes firms setting up specific firm level environmental goals and enhancing unlisted firms' environmental awareness. Fourth, institutional development is important for the success of environmental policy. Hence, it is important to reaffirm that the institutional framework should be transparent and accountable.

While we explore the ability of firms to obtain GV from manufacturing, retail and services industries, our analysis could be expanded upon to investigate a broader range of industries. Follow-up studies could employ longer time periods and methodologies to identify the long-run impact of obtaining GV. This could empirically identify the economic impact of relief programs and others of this ilk and would provide further evidence on the benefits, or not, of providing packages such as these.

[4] Full results can be obtained from the authors upon request.

Table 5
Sub sample analysis.

Panel A	Subgroup A: Eastern Europe					Subgroup B: Central Asia				
	Gov_Support (1)	Cash_Support (2)	Credit_Support (3)	Excemp_Support (4)	Wage_Support (5)	Gov_Support (6)	Cash_Support (7)	Credit_Support (8)	Excemp_Support (9)	Wage_Support (10)
Panel A: Main Equation										
ei1	.0476**	.0716**	.0290	.0511**	.0292	.0478	.0239	−0.0469	−0.0602	.0168
	(0.0198)	(0.0247)	(0.0284)	(0237)	(0.0194)	(0.0409)	(0.0528)	(0.0668)	(0.0508)	(0.0402)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cons	−1.015***	−1.371***	−1.948***	−1.705***	−1.208***	−0.9915***	−1.915***	−2.128***	−1.896***	−1.316***
	(0.1553)	(0.2140)	(0.2272)	(0.1935)	(0.1449)	(0.2515)	(0.3463)	(0.4701)	(0.2945)	(0.2267)
Panel B: sales_dec										
temp_close	.7503***	1.009***	.7486***	.7485***	.7526***	.8156***	.8139***	.8114***	.8101***	.8219***
	(0.034)	(0.0165)	(0.0341)	(0.0342)	(0.0340)	(0.0682)	(0.0682)	(0.0684)	(0.0685)	(0.0671)
Cons	.0076	.0042	.0067	.0068	.0075	−0.0171	−0.0188	−0.0189	−0.0191	−0.0179
	(0.0180)	(0.0185)	(0.0180)	(0.0180)	(0.0179)	(0.0361)	(0.0360)	(0.0360)	(0.0361)	(0.0359)
ei1										
avg_ei1	1.009***	1.009***	1.009***	1.009***	1.009***	.9817***	.9818***	.9817***	.9816***	.9814***
	(0.0165)	(0.0165)	(0.0165)	(0.0165)	(0.0165)	(0.0355)	(0.0355)	(0.0355)	(0.0355)	(0.0355)
Cons	.0042	.0042	.0042	.0042	.0042	.0060	.0060	.0059	.0059	.0059
	(0.0185)	(0.0185)	(0.0185)	(0.0185)	(0.0185)	(0.0377)	(0.0377)	(0.0377)	(0.0377)	(0.0377)
var(e.ei1)	2.468	2.468	2.468	2.468	2.468	2.363	2.363	2.363	2.363	.9814***
	(0.0245)	(0.0245)	(0.0245)	(0.0245)	(0.0245)	(0.0532)	(0.0532)	(0.0532)	(0.0532)	(0.0355)
corr(e.sales_dec, e.gov_support)	−0.2435***	.1073	−0.3378***	−0.3226***	−0.4606***	−0.4411***	−0.4073**	−0.0433	−0.4988***	−0.6378***
	(0.0703)	(0.0894)	(0.0871)	(0.0776)	(0.0593)	(0.1173)	(0.1294)	(0.2005)	(0.1246)	(0.0864)
corr(e.ei1, e.gov_support)	−0.0435	−0.0893*	−0.0083	−0.0742*	−0.0053	−0.0152	−0.0201	.1028	.1367	.0489
	(0.0345)	(0.0433)	(0.0488)	(0.0416)	(0.0340)	(0.0699)	(0.0875)	(0.1116)	(0.0858)	(0.0690)
corr(e.ei1, e.sales_dec_covid)	−0.0155	−0.0156	−0.0155	−0.0159	−0.0162	−0.0457	−0.0452	−0.0449	−0.0460	−0.0476
	(0.053)	(0.0153)	(0.0153)	(0.0153)	(0.0153)	(0.0308)	(0.0309)	(0.0309)	(0.0311)	(0.0309)

Panel B	Subgroup A: High governance index					Subgroup B: Low governance index				
	Gov_Support (1)	Cash_Support (2)	Credit_Support (3)	Excemp_Support (4)	Wage_Support (5)	Gov_Support (6)	Cash_Support (7)	Credit_Support (8)	Excemp_Support (9)	Wage_Support (10)
Panel A: Main Equation						*Panel A: Main Equation*				
ei1	.0619**	.0939**	.0604*	.0741**	.0277	.0244	.0200	−0.0406	−0.0242	.0199
	(0.0236)	(0.0296)	(0.0345)	(0.0278)	(0.0233)	(0.0271)	(0.0340)	(0.0401)	(0.0336)	(0.0262)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cons	−1.058***	−1.360***	−1.707***	−1.719***	−1.217***	−0.9312***	−1.692***	−2.575***	−1.744***	−1.250***
	(0.1745)	(0.2425)	(0.2500)	(0.2134)	(0.1623)	(0.2066)	(0.2832)	(0.3945)	(0.2583)	(0.1868)
Panel B: sales_dec										
temp_close	.7628***	.7598***	.7602***	.7609***	.7653***	.7627***	.76115***	.76115***	.7601***	.7656***
	(0.0405)	(0.0406)	(0.0406)	(0.0405)	(0.0403)	(0.0225)	(0.0465)	(0.0465)	(0.0465)	(0.0461)
Cons	.0064	.0048	.0051	.0052	.0062	−0.0019	−0.0026	−0.0026	−0.0027	−0.0021
	(0.0212)	(0.0212)	(0.0212)	(0.0212)	(0.0212)	(0.0246)	(0.0246)	(0.0246)	(0.0246)	(0.0246)
ei1										
avg_ei1	1.0073***	1.0073***	1.0073***	1.0073***	1.0073***	1.001***	1.001***	1.001***	1.001***	1.001***
	(0.02008)	(0.02008)	(0.02008)	(0.02008)	(0.02008)	(0.0225)	(0.0225)	(0.0225)	(0.0225)	(0.0225)
Cons	.0070	.0070	.0070	.0070	.0070	.0027	.0027	.0027	.0027	.0027
	(0.0220)	(0.0220)	(0.0220)	(0.0220)	(0.0220)	(0.0252)	(0.0252)	(0.0252)	(0.0252)	(0.0252)
var(e.ei1)	2.516	2.516	2.516	2.516	2.516	2.355	2.355	2.355	2.355	2.355
	(0.0284)	(0.0284)	(0.0284)	(0.0284)	(0.0284)	(0.0357)	(0.0357)	(0.0357)	(0.0357)	(0.0357)
corr(e.sales_dec, e.gov_support)	−0.2713***	.1206	−0.2204**	−0.3965***	−0.4618***	−0.3087***	−0.1852	−0.3736***	−0.3048**	−0.5552***
	(0.0811)	(0.1001)	(0.1117)	(0.0828)	(0.0687)	(0.0922)	(0.1150)	(0.1137)	(0.1113)	(0.0724)
corr(e.ei1, e.gov_support)	−0.0832**	−0.1466**	−0.0532	−0.1156**	−0.0161	.0289	.0190	.0873	.0684	.0442
	(0.0414)	(0.0519)	(0.0594)	(0.0492)	(0.0411)	(0.0461)	(0.0577)	(0.0679)	(0.0574)	(0.0451)
corr(e.ei1, e.sales_dec_covid)	−0.0181	−0.0184	−0.0182	−0.0183	−0.0186	−0.0249	−0.0242	−0.0247	−0.0250	−0.0262
	(0.0181)	(0.0181)	(0.0181)	(0.0180)	(0.0181)	(0.0209)	(0.0210)	(0.0210)	(0.0210)	(0.0209)

Table 5 reports eprobit results with endogenous covariate and selection bias for environmental performance. Table 5 replicates Table 3, with the only difference being that we separate Eastern Europe from Central Asia in Panel A, and separate firms with a high governance index from those with a low gonvernance index in Panel B. Columns 1 to 5, of Panel A, report regression results for Government Support (*Gov_Support*), Cash Support (*Cash_Support*), Credit Support (*Credit_Support*), Exemption Support (*Exemp_Support*), and Wage Support (*Wage_Support*) as dependent variables, respectively. Columns 6 to 10 replicate the regression results for Central Asia. In Panel B, the same method is used for high and low governance index firms. The base group for firm size is micro firms (less than 5 employees) and the base group for the industry is services. Standard errors are in parentheses. * Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

CRediT authorship contribution statement

Nirosha Wellalage: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Supervision. **Krishna Reddy:** Conceptualization, Writing – original draft, Writing – review & editing. **Damien Wallace:** Methodology, Writing – review & editing, Visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix

Table A1
Principal components/correlation Number of observations: 12,986 Number of components: 10 Rotation: (unrotated = principal), Rho = 1.0000.

Component	Eigenvalue	Difference	Proportion	Cumulative
1	4.2888	2.3332	0.3574	0.3574
2	1.9556	0.8014	0.1630	0.5204
3	1.1542	0.2978	0.0962	0.6166
4	0.8564	0.0916	0.0714	0.6879
5	0.7648	0.0917	0.0637	0.7516
6	0.6731	0.0142	0.0561	0.8077
7	0.6588	0.0534	0.0549	0.8626
8	0.6055	0.0751	0.0505	0.9131
9	0.5304	0.0179	0.0442	0.9573
10	0.5125	0.5125	0.0427	1.0000

This table provides the details of the Principal Component Analysis. As accepted in the literature, we maintain the eigenvalues that are greater than one in our analysis.

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