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EXCHANGE RATE CHANGES AND ESG

Predicting Exchange Rate Changes Using Country Environmental, Social, and Governance Ratings

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ABSTRACT

We examine the ability of country ESG ratings, which assess a country's performance on environmental, social, and governance (ESG) risk factors, to predict future one-year and two-year exchange rate changes. To conduct the study, we used the annual MSCI ESG Government Ratings from 2008 to 2018 for forty-two countries. Using statistical analysis, we find a significant relationship between a country's ESG ratings and the future change in the local currency. More specifically, we find that countries with high ESG ratings have significantly better-performing currencies than countries with lower ESG ratings. We find this result when predicting exchange rates one year and two years into the future using a host of controls.

INTRODUCTION

Exchange rate fluctuations are notoriously difficult to predict based purely on economic models, as evidenced broadly in the academic literature. Indeed, since Meese and Rogoff (1983), most research has found that economic models do a poor job of predicting exchange rate changes and that a simple random walk model does a better job of predicting future exchange rates than any economic model. For example, Rossi (2013) finds in a survey article that the amount of time needed to correct deviations from purchasing power parity (PPP) by 50 percent is three to five years. Furthermore, Ince (2014) finds that it is not until sixteen quarters in the future that PPP outperforms a driftless random walk model. Before this time, a simple random walk outperforms.

Given the poor ability of economic models to predict short- and medium-term exchange rates, we examine the ability of country ESG ratings to predict future one- and two-year exchange rate changes. As such, this is the first paper that we know of to link country ESG ratings to the prediction of exchange rates. These country ESG ratings are similar in spirit to ESG factors that have been used for years to evaluate the risks of companies pursuing value-destroying ESG policies and practices. However, rather than evaluating these issues at the corporate level, the country ESG ratings specifically examine a country's ESG risk factors that may affect the long-term sustainability of the country's economy.

Our premise is that investors do not fully incorporate ESG information. That is, investors do not fully account for how ESG issues impact a country's long-term competitiveness. As a result, currencies may not reflect their true value, and hence the traditional models do not predict well. For example, investors may underestimate how a country is impacted by its ability to develop a healthy, productive, and stable workforce and create a supportive economic environment. Similarly, investors may not appreciate how a country's financial, judicial, and political systems can impact its long-term competitiveness. The reason investors underappreciate these issues is that they lack information about the value of these factors, because these factors typically have not been measured.

The inability to account for these ESG issues manifests itself in currencies in at least two ways. First, because investors have underestimated ESG issues, they are surprised by new ESG incidents, which then impact the currency values. Hence, countries with lower ESG ratings (and therefore higher ESG risk) likely will have worse-performing currencies. Second, the downstream reputational losses from past ESG incidents may result in many future negative consequences for a country's currency. For example, negative ESG issues could cause investors to stay clear of the country for much longer than the ESG incident, exacerbating losses in the local currency. Moreover, companies in the country may have less-motivated employees or receive less-attractive prices for the firm's products due to ESG incidents (Glossner 2021). Over time, these issues will create lower profits for companies and thus impact currency values.

Our view is similar to that of Glossner (2021), which finds that stock markets underestimate the negative consequences of high ESG risks. Our view is also similar to an extensive stream of research that has found markets underestimate the value of intangibles. For example, this research has found that stock markets underestimate the value of employee satisfaction (Edmans 2011; Edmans et al. 2020), innovation (Cohen et al. 2013; Hirshleifer et al. 2013), advertising (Chan et al. 2001), patent citations (Deng et al. 1999), and software developments (Aboody and Lev 1998). Again, because their impact is unclear, all these intangibles are underestimated, because investors do not know how to value them.

We find results that support our hypothesis that countries with better ESG ratings (and hence lower ESG risk) have better-performing currencies. Using annual MSCI ESG Government Ratings from 2008 to 2018 for forty-two countries, we find a significant relationship between a country's ESG rating and the future change in the local currency. More specifically, we find that countries with high ESG ratings have significantly better-performing currencies compared with countries with lower ESG ratings. We find this result when predicting exchange rates one year and two years into the future using a host of controls for exchange rate movements.

BACKGROUND

ESG factors have been used for years to evaluate the risk of companies (at the corporate level) incurring value-destroying ESG incidents.[1] Typical company-level ESG factors incorporate a large range of topics that are not conventionally included in financial analysis but may have financial significance. For example, environmental (E) may include how a company responds to carbon emissions, waste management, or water supply; social (S) could include how well a company treats its workers and other human capital and whether its culture fosters trust and innovation; and governance (G) may cover efforts to promote board diversity, combat corruption, and support ethical political and business-practice efforts. Indeed, for a specific example of how ESG risks can impact a company, consider British Petroleum (BP). The 2010 explosion of BP's Deepwater Horizon well in the Gulf of Mexico caused an environmental disaster that cost the firm an estimated $40 billion (Shefrin and Cervellati 2011). Some have argued (Statman 2010; Shefrin and Cervellati 2011) that BP's true environmental risks had not been incorporated and properly discounted by investors and, as a result, investors suffered huge losses.

In terms of how company-level ESG has impacted performance, the evidence is mixed. A number of studies have found a negative relationship between ESG ratings and risk-adjusted performance. Hong and Kacperczyk (2009), Fabozzi et al. (2008), Statman and Glushkov (2009), Borgers et al. (2015), Richey (2016), and El Ghoul and Karoui (2017) all find that sin stocks, i.e., those with low ESG ratings, have better returns than stocks with high ESG ratings. The argument here is that because investors stay away from low ESG stocks, prices are lower, and thus returns are greater for the investor.

On the other hand, Rathner (2013), Henke (2016), and Hübel and Scholz (2019) have found a positive relationship between ESG ratings and risk-adjusted returns. Moreover, Dunn et al. (2018) find that stocks with very low ESG ratings have substantially higher volatility than stocks with very high ESG ratings. Indeed, the authors find the volatility of the lowest ESG stocks is up to 15-percent higher than the volatility of those with the highest ESG ratings. Therefore, a method of reducing risk is to hold stocks with higher ESG ratings. Similarly, Khan (2019) found that ESG measures predict global stock returns well. In tests of return predictability that controlled for style, time, and sector differences, Khan (2019) finds a long-only portfolio of the top quartile of governance scores outperformed the global universe by 40 basis points. Serafeim (2020) finds that public sentiment influences investor views about the value of corporate ESG activities. The author provides evidence that an ESG factor long on companies with superior sustainability performance and negative ESG sentiment momentum and short on companies with inferior sustainability performance and positive ESG sentiment momentum yields significant positive alpha. At the government level, Baker et al. (2021) find a negative relation between ESG ratings and initial public offering underpricing, consistent with higher ESG ratings being associated with lower information asymmetry.

Survey articles provide another measure of the impact of ESG on performance. Clark et al. (2015) examined more than 200 sources—including academic research, industry reports, newspaper articles, and books—and found that "80 percent of the reviewed studies demonstrate that prudent sustainability practices have a positive influence on investment performance." Similarly, a study by the Asset and Wealth Management division of Deutsche Bank (2015) investigated 2,250 academic studies published on the subject from 1970 to 2014. Deutsche Bank (2015) found that ESG made a positive contribution to corporate financial performance in 62.6 percent of the cases and produced negative results in only 10 percent of cases, and the remainder were neutral.

Therefore, although some studies find a neutral or negative relationship between performance and ESG, the majority seem to indicate that there is a positive relationship.

MSCI ESG GOVERNMENT RATINGS

The research conducted on ESG over the past forty years has been almost exclusively at the corporate level. Recently, however, a number of data providers (MSCI, Institutional Shareholder Services [ISS], Sustainalytics, Robeco) have started providing ESG measures on countries. These ratings assess a country's performance on ESG risk factors affecting its value creation process.

In this study, we decided to use the MSCI Government ESG ratings (which are country-wide ESG ratings) to examine their ability to predict exchange rate changes. As such, this is the first paper that we know of to link countrywide ESG ratings to currencies.

We chose the MSCI ratings because MSCI is the largest company to provide these ratings and because, among ratings providers, it has a long track record and wide coverage. The MSCI ratings start in January 2008, earlier than most other providers,

thus allowing us to examine a longer sample period. The MSCI ratings cover 198 countries and more than 99 percent of the sovereign debt market; this is significantly more coverage than the other rating services.[2] For all these reasons, we also expect investors and finance professionals to be more familiar with MSCI ESG ratings than other ESG ratings.

The MSCI Government ESG ratings specifically examine individual country performance on environmental, social, and governance risk factors, which are considered to be the three pillars that affect the long-term sustainability of the country's economy (MSCI 2019). For the environmental pillar (E), MSCI assesses the extent to which a country's long-term competitiveness is impacted by its ability to protect, harness, and supplement its natural resources and to manage environmental vulnerabilities and externalities. For the social pillar (S), MSCI examines the extent to which a country's long-term competitiveness is affected by its ability to develop a healthy, productive, and stable workforce, knowledge capital, and a supportive economic environment. For the governance pillar (G), MSCI measures the extent to which a country's long-term competitiveness is impacted by its institutional capacity to support the long-term stability and functioning of its financial, judicial, and political systems and its capacity to address environmental and social risks.

To arrive at a country's ESG rating, MSCI uses an extensive process that is summarized briefly below and in table 1.[3]

First, MSCI defines six risk factors—two for each of the E, S, and G pillars—for each country:

1. Natural resource risk (E): the risk of not having and not managing natural resources
2. Environmental externalities and vulnerability risk (E): the risk of resources and enabling environment being vulnerable to environmental events and exposed to environmental externalities
3. Human capital risk (S): the risk of not having balanced and productive human capital
4. Economic environment risk (S): the risk of not having a conducive economic environment to utilize resources effectively
5. Financial governance risk (G): the risk of not having sufficient financial capital to manage resources and other ESG risks
6. Political governance risk (G): the risk of not having an effective political governance structure

For each of these six risk factors, MSCI creates two subgroups, risk exposure and risk management. Risk exposure measures the natural, financial, and human resources of the country; risk management measures how well the country manages these resources. Thus, there are now twelve risk-factor groups (two sub-groups for each of the six risk factors).

For these twelve risk-factor groups, MSCI then applies twenty-seven sub-factors. Table 1 shows all the risk factors, sub-groups,

Table 1

WEIGHTS OF MSCI RATINGS

Pillar	Risk Factor	Weight (%)	Risk Exposure	Weight (%)	Risk Management	Weight (%)
Environmental	Natural Resource	18%	• Energy Security Risk	6%	• Energy Resource Management	6%
			• Water Resources	6%	• Water Resource Management	6%
			• Productive Land and Mineral Resources	6%	• Resource Management	6%
	Environmental Externalities and Vulnerability	7%	• Vulnerability to Environmental Events	3%	• Environmental Performance	3%
			• Environmental Externalities	4%	• Management of Environmental Externalities	4%
Social	Human Capital	15%	• Basic Human Capital	5%	• Basic Needs	5%
			• Higher Education and Technological Readiness	6%	• Human Capital Performance • Human Capital Infrastructure	3%
			• Knowledge Capital	4%	• Knowledge Capital Management	4%
	Economic Environment	10%	• Economic Environment	10%	• Wellness	10%
Governance	Financial Governance	20%	• Financial Capital and Trade Vulnerability	20%	• Financial Management	20%
	Political Governance	30%	• Institutions	10%	• Stability and Peace	10%
			• Judicial and Penal Systems	10%	• Corruption Control	10%
			• Governance Effectiveness	10%	• Political Rights and Civil Liberties	10%

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and sub-factors. For example, the "Risk Exposure Natural Resource" risk-factor group covers three of the twenty-seven sub-factors: "Energy Security Risk," "Water Resources," and "Productive Land and Mineral Resources."

To assess the twenty-seven sub-factor groups, MSCI uses ninety-nine different data points for each country. For example, for the "Energy Security Risk" sub-factor, MSCI uses data about "proven fossil and nuclear fuel reserves," which comes from the U.S. Central Intelligence Agency and the U.S. Energy Information Administration (EIA); and data about "energy imports," which comes from the EIA and the World Bank's World Development Indicators.

MSCI uses data from many different sources for these ninety-nine different data points, including, for example, particulate matter concentrations, adult literacy levels, ease of doing business indexes, the rule of law, ability to enforce contracts, corruption, current account balances, property rights, civil liberties, and youth unemployment; find the complete list at MSCI (2019, 37–51).

Finally, to determine the overall country rating, MSCI weights the governance portion of the ESG by 50 percent and allots the environmental and social portions 25 percent each. The governance pillar is given a higher weight because, according to MSCI, "governance offers the most dynamic ways to influence the management of environmental, social and institutional risks."

As MSCI (2019) states:

> *Financial governance is a key component of our framework. We believe that ESG Sovereign Risk cannot be isolated from a country's basic fiscal conditions when assigning ESG Ratings; the two are inextricably linked. Countries with a healthy fiscal balance sheet have greater latitude to invest in purposeful governance programs to manage social and environmental risks and support long-term sustainability goals. Similarly, however, we believe traditional sovereign debt ratings do not account sufficiently for ESG risk and so may result in an incomplete view of a nation's long-term creditworthiness.*

Table 1 also shows the various weights assigned to the sub-factors. MSCI determined the weight of each sub-factor after assessing the impact intensity of that sub-factor on the long-term competitiveness of the country over the short, medium, and long term. Factors that had a big impact over the short-term were given more weight (MSCI 2019, 12).

Finally, as shown in table 1, MSCI calculates the composite ESG score using two versions of E, S, and G: a risk-exposure E, S, and G; and a risk-management E, S, and G. As stated above, the risk-exposure measure describes the resources of the country and the risk-management measure describes how well those resources are managed. The country's composite ESG score is constrained by its risk-management score if its overall risk management is weak (MSCI 2019, 16). This minimum risk-management constraint threshold reflects MSCI's view that a country with poor risk management may not be able to harness its available resources effectively, even if those resources are abundant.

As a result of this process, MSCI assigns a composite ESG score for every country in January each year. The higher the score, the lower the country's ESG risks. In our sample, the country with the highest average composite score was Norway with 8.62, and the country with the lowest average composite score was Egypt with 3.45.

DATA

The MSCI ESG Government Ratings begin in January 2008 and cover 198 countries. The ratings are updated each year in January. This study used data for the period 2008–2018. We chose to examine forty-two countries; these are countries with currencies that were not completely pegged for the period 2008–2018 and for which we had currency and PPP data. For example, Hong Kong is not included because its currency was pegged at the same level for the entire sample period. China is included because its currency level varied somewhat during the sample period. Note, however, that the results in the paper are essentially the same if we include or exclude China. Given this, and the size of China, we decided to include it in our sample.

For each of the forty-two countries in our study, our data collection comprised the following:

- We collected the MSCI ESG Government Ratings assigned each January from 2008 to 2018.
- We collected the annual percentage change (January to December) in each country's spot exchange rates for each year from 2008 to 2018. Note that the exchange rates used are all in terms of how much one U.S. dollar (USD) buys of local currency. Therefore, if the local currency is appreciating (depreciating), the exchange rate is declining (increasing).
- For each January from 2008 to 2018, we also collected the separate risk-management MSCI environmental, social, and governance scores; i.e., only six of the twelve E, S, and G sub-group scores were used to calculate the ESG composite score. As noted above, MSCI puts a premium on the risk-management ESG scores; a country's composite ESG score is constrained by its risk-management score if its overall risk management is weak. Because the risk-management score is more important, we decided to use only the individual E, S, and G from the risk-management side rather than including the risk-exposure side.
- We also collected the percentage of USD overvaluation arising from PPP for January of each year from 2008 to 2018. This USD overvaluation is calculated as [(spot rate – PPP

exchange rate)/(PPP exchange rate)] × 100. Note, all exchange rates are in terms of how much one USD buys of local currency. Hence, positive values for overvaluation indicate the percentage that the USD is overvalued relative to what it should be according to PPP. Negative values indicate the percentage the USD is undervalued relative to its PPP value. The PPP exchange rate is the exchange rate that equalizes the purchasing power of the two currencies. The PPP exchange rate data is from the World Bank and the Organisation for Economic Co-operation and Development.

- For each year from 2008 to 2018, we also collected the following annual World Bank data: gross domestic product (GDP) growth rates, GDP/employee (as a measure of productivity), interest rates, money growth rates, current account/GDP ratio, and the ratio of foreign direct investment to GDP (FDI/GDP). These measures have all been used in various traditional exchange rate models, as outlined by Rossi (2013).

RESULTS

Tables 2, 3, and 4 present the descriptive, summary, and correlation statistics for the data and reveal several interesting results. Tables 5, 6, and 7 present statistics used to see how well ESG scores can predict exchange rates one year into the future. Tables 8, 9, and 10 present statistics used to see how well ESG scores can predict exchange rates two years into the future.

DESCRIPTIVE, SUMMARY, AND CORRELATION STATISTICS

Table 2, column 2, labeled ΔEXCH (%), provides the average annual percentage change in the exchange rate over the period 2008–2018 for each of the forty-two countries in the study. Here, we see that Canada has the highest value (22.56 percent) and Switzerland has the lowest value (-0.96 percent). Note that positive values here indicate the annual average change in the exchange rate involved a depreciation in the local currency compared with the USD, and negative values indicate the local currency appreciated relative to the USD. Table 2, column 2, shows that the vast majority of countries have positive averages, indicating that the local currency depreciated relative to the USD during 2008–2018.

Table 2, column 3, shows the average annual composite ESG score for each country over the period 2008–2018. The annual averages vary greatly among countries. The country with the highest average ESG score is Norway (8.62), and the country with the lowest average ESG score is Egypt (3.45).

Table 2, columns 4, 5, and 6, show the average annual individual E, S, and G scores from the risk-management portion of the MSCI ESG methodology. The correlations between the average annual composite scores (table 2, column 3) and the average annual E, S, and G scores were 0.48 for E, 0.78 for S, and 0.91 for G (see table 4). Hence, the composite score is most correlated to the G score, less correlated to the S score, and least correlated to the E score. This makes sense because the G score is given a much higher weight than the S or E scores in the overall composite.

Table 2, column 7, shows the average annual percentage of USD overvaluation relative to PPP, which we denote as PPP Over. Here again, positive values indicate the percentage that the USD is overvalued relative to what it should be according to PPP. Negative values indicate the percentage the USD is undervalued relative to the PPP value. Table 2, column 7, shows that some countries had very large average annual USD overvaluations during 2008–2018. For example, the USD was, on average, 200-percent overvalued compared with Vietnam's currency according to PPP. Thus, Vietnam's local currency was extremely undervalued throughout this period compared with the USD. Interestingly, the correlation between the average annual composite ESG (table 2, column 3) and the average annual percentage of USD overvaluation relative to PPP (table 2, column 7) is quite large (-0.79; see table 4). Hence, countries with high composite ESG scores have much less USD overvaluation relative to PPP, and countries with low ESG scores, on average, experience much higher USD overvaluation relative to PPP.

Table 3 presents summary statistics that show the mean, median, and 25th and 75th percentiles for the variables used in the regressions. Here we highlight our control variables, which include a variety of variables that are associated with exchange rate determination in the literature (Rossi 2013).

These include the following variables, with their units of expression shown in parentheses; note that all variables are expressed as percentages except for ΔGDP/employee, which is expressed in PPP dollars:[4]

PPP Over (%), mentioned above, measures the amount of overvaluation in the currency from the PPP exchange rate. PPP Over is related to the PPP model for exchange rate determination, which is based on inflation-rate differentials between countries.

ΔΔGDP (%) is the difference between the GDP percentage growth rate in the local country and the United States. ΔΔGDP is related to the output model of exchange rates, which says that exchange rates are related to the difference in growth rates of countries.

ΔGDP/employee (PPP$) is the difference between the GDP/employee in the local country and in the United States in PPP dollars. ΔGDP/employee is related to the productivity model in exchange rates, which says that productivity differences between countries impact exchange rates.

Table 2

DESCRIPTIVE STATISTICS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country	ΔEXCH (%)	ESG score	E score	S score	G score	PPP Over (%)
Algeria	5.7247	4.7907	4.4933	5.9605	4.8946	187.5822
Argentina	20.2019	5.9008	5.5404	6.8694	5.4944	49.2275
Australia	2.9176	7.3969	4.7493	8.8017	7.2707	-19.4218
Brazil	9.1871	5.7169	7.1395	6.3003	5.1660	46.5611
Bulgaria	2.4909	5.5424	4.3309	6.9000	5.4061	124.3374
Canada	22.5577	8.1102	6.7507	9.1623	8.5513	–19.2058
Chile	4.0169	7.0996	5.8119	7.1158	7.4944	52.6314
China	–0.6491	5.1250	4.3616	6.3376	4.6827	91.6697
Colombia	5.2138	5.2328	7.3237	4.9271	3.6179	94.6004
Croatia	2.6940	5.7586	7.2053	7.4872	5.6241	63.6956
Czech Republic	2.2766	6.3557	5.7997	8.4554	6.2263	58.6855
Denmark	2.5148	8.1257	6.8329	9.0726	8.8222	–20.7998
Egypt	15.1544	3.4505	4.6318	5.4712	2.9693	282.2893
Hungary	4.9338	5.7885	5.6301	7.7431	5.8373	77.1662
India	5.6749	4.2090	3.7790	4.4438	4.5514	246.6781
Indonesia	4.4694	4.7967	6.1272	4.6650	4.8988	202.5547
Israel	–0.0450	5.7986	4.8905	8.5267	5.1596	–3.8344
Japan	0.4958	6.4997	5.6139	8.7400	7.2095	–4.2439
Kazakhstan	13.1113	5.0488	3.2479	6.4994	3.9046	123.5758
Malaysia	2.4058	6.2525	6.1777	7.0434	5.4264	149.7190
Mexico	6.1650	5.1743	5.6313	6.4273	4.9068	80.1177
New Zealand	3.1605	7.7254	7.1974	8.3551	7.8735	–4.9600
Norway	5.0261	8.6206	6.5146	9.2855	9.2269	–28.4952
Peru	1.3542	5.8282	6.5445	5.8386	5.3327	98.0869
Philippines	2.4094	5.0227	6.2838	5.1178	4.9457	155.5582
Poland	4.6193	5.8705	5.6922	7.6450	5.7944	82.6622
Romania	4.1797	5.3678	6.0970	7.0476	4.9972	110.8020
Russia	12.0848	5.6313	5.2886	6.9867	4.0103	105.2457
Serbia	6.7877	5.4172	7.1813	6.4316	4.5062	122.7828
Singapore	–0.3873	6.5213	4.4905	7.9088	8.3554	54.9751
South Africa	8.9659	5.1120	3.4505	4.0251	4.7649	90.4228
South Korea	2.1981	6.5769	4.7083	8.8357	6.9875	31.5908
Sweden	3.4693	8.4331	7.0423	8.8660	9.2667	–16.2173
Switzerland	–0.9593	8.2629	7.7913	9.2604	9.2954	–27.1082
Thailand	–0.1561	5.1444	4.7313	6.4189	4.5059	170.0511
Tunisia	8.4513	4.3994	4.6659	5.9088	4.4094	167.5614
Turkey	15.5428	4.6489	5.8924	6.4301	3.5889	90.9276
Ukraine	20.0889	4.6286	4.3860	6.9595	3.3956	164.0234
United Kingdom	4.8330	6.6145	6.4485	8.3640	6.5535	–6.6365
Uruguay	4.5113	6.5285	6.5176	7.2947	6.6511	34.3580
Vietnam	3.4754	4.7162	5.0272	5.4716	3.7722	199.9131
Zambia	11.8485	4.4381	5.5198	2.3249	4.6553	129.9047

Table 3

SUMMARY STATISTICS

Variables*	25th Percentile	Median	Mean	75th Percentile	N
ΔEXCH (%)	−2.4403	3.2943	5.6590	10.6437	442
ESG score	4.9876	5.6981	5.8321	6.5080	442
E score	4.7277	5.5946	5.6096	6.4431	442
S score	5.9626	6.8064	6.8895	8.2623	442
G score	4.4053	5.3033	5.6533	6.8413	442
PPP Over (%)	27.4075	79.9899	88.5526	143.3424	442
ΔΔGDP (%)	−0.3249	1.1566	1.4355	3.2919	442
ΔGDP/employee (PPP$)	−88,894.84	−71,484.63	−64,799.45	−46,543.45	442
ΔInterest (%)	1.5048	4.7400	6.2070	8.4075	345
ΔΔMoney (%)	0.6815	4.3240	5.6046	9.2453	442
ΔCurrent/GDP (%)	−0.8504	1.5308	2.7833	5.7446	442
ΔFDI/GDP (%)	−3.2201	−1.8314	−1.8050	−0.0614	442

**See text for variable definitions.*

Table 4

CORRELATION COEFFICIENTS FOR VARIABLE PAIRS

Variables *	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ΔEXCH (%) (1)	1	−0.1452	−0.0957	−0.1183	−0.1696	−0.0182	−0.1574	−0.0561	0.1776	0.3248	−0.1859	0.0210
		(0.00)	(0.04)	(0.01)	(0.00)	(0.70)	(0.00)	(0.24)	(0.00)	(0.00)	(0.00)	(0.66)
ESG score (2)	−0.1452	1	0.4769	0.7765	0.9120	−0.7931	−0.2534	0.7022	−0.2704	−0.3319	0.3915	0.3204
	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
E score (3)	−0.0957	0.4769	1	0.2713	0.3477	−0.3846	−0.1794	0.2155	0.1743	−0.1408	−0.0056	0.1787
	(0.04)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.91)	(0.00)
S score (4)	−0.1183	0.7765	0.2713	1	0.6693	−0.6880	−0.3396	0.8263	−0.3351	−0.3441	0.3249	0.3044
	(0.01)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
G score (5)	−0.1696	0.9120	0.3477	0.6693	1	−0.6905	−0.1418	0.6342	−0.3164	−0.3228	0.4720	0.2582
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
PPP Over (%) (6)	−0.0182	−0.7931	−0.3846	−0.6880	−0.6905	1	0.2708	−0.6759	0.1348	0.2092	−0.2535	−0.2011
	(0.70)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
ΔΔGDP (%) (7)	−0.1574	−0.2534	−0.1794	−0.3396	−0.1418	0.2708	1	−0.3822	−0.0782	0.2970	0.0586	−0.2703
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.15)	(0.00)	(0.22)	(0.00)
ΔLn(GDP/ employee) (8)	−0.0561	0.7022	0.2155	0.8263	0.6342	−0.6759	−0.3822	1	−0.3461	−0.3817	0.3132	0.2914
	(0.24)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
ΔInterest (%) (9)	0.1776	−0.2704	0.1743	−0.3351	−0.3164	0.1348	−0.0782	−0.3461	1	0.3105	−0.2627	−0.2336
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.15)	(0.00)		(0.00)	(0.00)	(0.00)
ΔΔMoney (%) (10)	0.3248	−0.3319	−0.1408	−0.3441	−0.3228	0.2092	0.2970	−0.3817	0.3105	1	−0.1201	−0.2053
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.01)	(0.00)
ΔCurrent/ GDP (%) (11)	−0.1859	0.3915	−0.0056	0.3249	0.4720	−0.2535	0.0586	0.3132	−0.2627	−0.1201	1	0.2394
	(0.00)	(0.00)	(0.91)	(0.00)	(0.00)	(0.00)	(0.22)	(0.00)	(0.00)	(0.01)		(0.00)
ΔFDI/GDP (%) (12)	0.0210	0.3204	0.1787	0.3044	0.2582	−0.2011	−0.2703	0.2914	−0.2336	−0.2053	0.2394	1
	(0.66)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

**See text for variable definitions. Significance tests for the correlations are represented by p-values shown in parentheses.*

ΔInterest (%) is the difference between the lending rates that meet the short- and mid-term financing needs of the private sector in the local country and in the United States. ΔInterest is related to the interest rate parity model of exchange rates. Note, we only use this variable in tables 7 and 10 because we have a limited amount of interest rate data. There are 345 total observations of interest rate differential data and 442 observations for the other variables.

ΔΔMoney (%) is the difference between the broad money percentage growth rate in the local country and the United States. ΔΔMoney is related to the monetary model of exchange rates, which says that the differences in money growth between countries are related to exchange rates.

ΔCurrent/GDP (%) is the difference between current account balance as a percentage of GDP in the local country and the United States. ΔCurrent/GDP is related to the current account model of exchange rate determination.

ΔFDI/GDP (%) is the difference between foreign direct investment as a percentage of GDP in the local country and the United States. ΔFDI/GDP is related to the foreign direct investment model of exchange rates.

Table 4 presents the correlation coefficients between the variables used in the study. The sign of the coefficient indicates the direction of the correlation, either positive or negative; and the magnitude of the correlation indicates the strength of the correlation, indicated by the value between −1 and +1. The significance tests for correlations are represented by the *p*-values shown in parentheses.

The correlations show that some of the control variables are highly correlated with ESG. Specifically, we find that PPP Over and ΔLn(GDP/employee) are correlated with ESG; PPP Over is correlated with ESG at a level of −0.79 and the change in the natural log (i.e., ΔLn) of GDP/employee is correlated with ESG at a level of 0.70. ΔΔGDP is somewhat correlated with ΔLn(GDP/employee) at a level of −0.38. Table 4 also shows that the individual E, S, and G variables are correlated with the ESG composite; this is not surprising because, taken together, they form the ESG composite.

PREDICTING FUTURE ONE-YEAR EXCHANGE RATE CHANGES

Table 5 shows how well the variables shown in table 3 predict the future one-year exchange rates in a univariate regression without controls. In other words, table 5 shows how well each variable alone without any controls predicts one-year future exchange rates.

We use a pooled regression in which we pooled all observations for the forty-two countries for each of the eleven years from 2008 through 2018, producing a sample of 442 observations.[5] Year fixed effects are used throughout to control for annual differences in the data. Table 5 shows a regression of the future one-year change in the spot exchange rate (January to December of the year) on each variable from January of that year. So, for example, we regress the change in the exchange rates from January 2010 to December 2010 on the ESG country score in January 2010. We do this to see how well each of the variables predict the one-year future exchange rate changes. Recall that all exchange rates are in terms of how much one USD buys of the local currency. Hence, increases in the exchange rate signify USD appreciation and local currency depreciation, and decreases in the exchange rate indicate USD depreciation and local currency appreciation.

Table 5(A) shows a negative and strongly significant relationship between the composite ESG scores and the future one-year exchange rate changes (in terms of how much one USD buys of the local currency). Hence, higher composite ESG scores are related to the USD performing relatively worse in the future (and thus the local currency improving). Conversely, lower ESG scores are related to the USD performing relatively better in the future (and thus the local currency deteriorating).

Table 5(B) shows how each of the other controls fared in terms of predicting the one-year future exchange rate changes. Again, all these regressions are univariate regressions without any controls. We see relatively mixed results with the other variables that have supposedly been linked to exchange rate changes. We see, for example, that PPP Over is not significantly related to future exchange rates, but several of the other controls are significantly related to future exchange rate changes.

Note that in table 5, the first principal component (PCA) is included among the controls. PCA is an optimally weighted linear combination of the highly correlated variables in our study to control for the distorting impact of multicollinearity. As mentioned above, PPP Over is correlated with ESG at a level of −0.79, ΔLn(GDP/employee) is correlated with ESG at a level of 0.70, and ΔΔGDP is somewhat correlated with ΔLn(GDP/employee) at a level of −0.38. These high correlations must be adjusted for or we face a multicollinearity problem. PCA allows us to control for these high correlations while controlling for the effects of PPP Over, ΔΔGDP, and ΔLn(GDP/employee) on the annual percentage change in the foreign exchange rate.

To better understand the results shown in table 5, consider that the constant for all countries is 25.55, so when the composite ESG is zero, the average percentage change in the future one-year exchange rate is 25.55 percent (i.e., the USD appreciated by 25.55 percent relative to the local currency). Then, for every one-unit increase in the composite ESG score, we see this

Table 5

PREDICTING ONE-YEAR FUTURE EXCHANGE-RATE CHANGES WITH UNIVARIATE REGRESSIONS

Dependent Variable: One-Year Future Percentage Change in Foreign Exchange Rate

(A): ESG factors				
ESG score	−1.7359***			
	(−3.48)			
E score		−0.8062		
		(−1.33)		
S score			−0.9969***	
			(−3.44)	
G score				−1.4751***
				(−3.90)
Constant	25.5500***	19.8802***	22.2708***	23.9158***
	(6.49)	(4.36)	(8.29)	(6.82)
Year fixed effects	YES	YES	YES	YES
Observations	442	442	442	442
R-squared	0.297	0.281	0.288	0.307

*See text for variable definitions. T-statistic values, estimated using standard errors clustered by country, are in parentheses. *, **, and *** indicate significance at the 10-, 5-, and 1-percent levels, respectively.*

(B): Control variables								
PPP Over (%)	0.0049							
	(0.72)							
ΔΔGDP (%)		−0.7315**						
		(−2.31)						
ΔLn(GDP/employee)			−1.4728					
			(−1.36)					
PCA				−1.1801				
				(−1.46)				
ΔInterest (%)					0.3938*			
					(1.99)			
ΔΔMoney (%)						0.7200***		
						(4.70)		
ΔCurrent/GDP (%)							−0.4703***	
							(−4.66)	
ΔFDI/GDP (%)								−0.2132
								(−0.88)
Constant	14.9162***	17.9563***	13.8565***	15.7065***	13.2654***	11.1164***	16.9665***	14.7363***
	(6.19)	(5.92)	(5.79)	(6.44)	(4.69)	(4.37)	(7.62)	(6.06)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	442	442	442	442	345	442	442	442
R-squared	0.278	0.297	0.282	0.283	0.305	0.399	0.311	0.279

percentage decrease by 1.7359 times the ESG score (because the coefficient on the ESG variable is −1.7359). Hence, Norway, which has the highest composite ESG score, would see, on average, a much greater improvement in its local currency than would Egypt, which has the lowest composite ESG score.[6]

Table 6 shows the ability of ESG to predict future one-year exchange rates using all the controls except interest rate differentials, which are not used here because our data was limited for interest rate differentials (results using interest-rate differentials as an added control are shown in table 7).

Table 6

REGRESSION OF ONE-YEAR FUTURE PERCENTAGE CHANGE IN SPOT EXCHANGE RATE ON COMPOSITE ESG SCORE USING CONTROLS

Dependent Variable: One–Year Future Percentage Change in Foreign Exchange Rate

ESG score	–1.9155**				–2.3864**			
	(–2.21)				(–2.39)			
E score		–0.9885*				–1.3167**		
		(–2.02)				(–2.13)		
S score			–1.3105**				–0.9945**	
			(–2.11)				(–2.34)	
G score				–0.7613				–1.1635*
				(–1.60)				(–1.81)
PPP Over (%)	–0.0189*	–0.0081	–0.0070	–0.0091				
	(–1.72)	(–0.92)	(–1.09)	(–1.06)				
ΔΔGDP (%)	–1.2173***	–1.2701***	–1.2682***	–1.1912***				
	(–3.16)	(–3.30)	(–3.10)	(–3.14)				
ΔLn(GDP/employee)	1.6730	0.7590	2.9615	1.4662				
	(1.05)	(0.42)	(1.36)	(0.85)				
PCA					–5.1044***	–3.9433***	–4.2967***	–4.2657***
					(–4.00)	(–4.37)	(–4.68)	(–4.05)
ΔΔMoney (%)	0.8452***	0.8677***	0.8665***	0.8528***	0.7902***	0.8313***	0.8064***	0.7922***
	(5.17)	(5.08)	(5.11)	(5.03)	(5.02)	(5.13)	(4.79)	(4.87)
ΔCurrent/GDP (%)	–0.2818**	–0.3615***	–0.3206***	–0.2817**	–0.2322*	–0.4005***	–0.3183**	–0.2420
	(–2.44)	(–2.92)	(–3.06)	(–2.20)	(–1.70)	(–3.31)	(–2.42)	(–1.58)
ΔFDI/GDP (%)	0.2012	0.1938	0.1811	0.1560	0.1960	0.2071	0.1735	0.1570
	(0.99)	(0.85)	(0.96)	(0.71)	(0.84)	(0.83)	(0.71)	(0.62)
Constant	30.7215***	23.6665***	29.0908***	22.6660***	27.9893***	21.3599***	20.7124***	20.3062***
	(4.59)	(5.54)	(5.90)	(5.05)	(3.88)	(4.47)	(4.47)	(3.82)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	442	442	442	442	442	442	442	442
R–squared	0.485	0.483	0.483	0.481	0.478	0.471	0.467	0.471

*See text for variable definitions. T-statistic values, estimated using standard errors clustered by country, are in parentheses. *, **, and *** indicate significance at the 10-, 5-, and 1-percent levels, respectively.*

The key columns to focus on in table 6 are columns 1 and 5. Table 6, column 1, shows the results of the regression of future one–year exchange rate changes on ESG using the controls. The ESG is still negatively and significantly related to future one–year exchange rates. Table 6, column 5, shows the results of a similar regression using PCA to take care of the possible multicollinearity problem that exists due to the high correlations between ESG and the PPP Over, ΔGDP/employee, and ΔΔGDP variables. As noted above, PCA is an optimally weighted linear combination of these highly correlated variables. The results shown in table 6, column 5, show that, after controlling for multicollinearity, there still exists a negative and significant relationship between ESG and one–year future exchange rate changes.

Table 7 shows the same regression as table 6, except that interest rate differentials are included as a control. Again, because interest rate differentials were not available for all the countries in our sample, the sample size in table 7 (345 observations) is smaller than the sample size in table 6 (442 observations). As with table 6, table 7 shows results without and with PCA (columns 1 and 5, respectively). The results show, again, that when including all the controls, the ESG measure is still negatively and significantly related to future exchange rate changes.

Table 7

REGRESSION OF ONE-YEAR FUTURE PERCENTAGE CHANGE IN SPOT EXCHANGE RATE ON COMPOSITE ESG SCORE USING CONTROLS AND INTEREST-RATE DIFFERENTIALS

Dependent Variable: One-Year Future Percentage Change in Foreign Exchange Rate

ESG score	−2.9823**				−3.5453***			
	(−2.36)				(−2.83)			
E score		−1.0995**				−1.5043**		
		(−2.31)				(−2.07)		
S score			−1.4035*				−1.2452***	
			(−1.97)				(−3.18)	
G score				−0.7103				−1.4054*
				(−1.31)				(−1.80)
PPP Over (%)	−0.0250*	−0.0073	−0.0068	−0.0072				
	(−1.74)	(−0.87)	(−1.08)	(−0.78)				
ΔΔGDP (%)	−1.3590***	−1.4523***	−1.4885***	−1.3823***				
	(−3.06)	(−3.51)	(−3.24)	(−3.17)				
ΔLn(GDP/employee)	1.4458	0.0242	2.1997	0.6559				
	(0.74)	(0.01)	(0.84)	(0.32)				
PCA					−5.8991***	−4.0289***	−4.6973***	−4.4516***
					(−3.82)	(−3.95)	(−5.33)	(−3.70)
ΔInterest (%)	−0.0186	0.0381	−0.0261	−0.0105	−0.0340	0.1147	0.0035	0.0037
	(−0.24)	(0.53)	(−0.38)	(−0.14)	(−0.35)	(0.93)	(0.03)	(0.04)
ΔΔMoney (%)	0.8459***	0.8529***	0.8723***	0.8609***	0.7874***	0.7894***	0.7876***	0.7885***
	(4.08)	(3.86)	(3.96)	(3.98)	(3.93)	(3.71)	(3.73)	(3.82)
ΔCurrent/GDP (%)	−0.2757**	−0.3271**	−0.2892**	−0.2619*	−0.2167	−0.3691**	−0.2797*	−0.2174
	(−2.07)	(−2.32)	(−2.29)	(−1.75)	(−1.39)	(−2.64)	(−1.82)	(−1.22)
ΔFDI/GDP (%)	0.0807	0.1020	0.0882	0.0427	0.0573	0.1796	0.1300	0.0563
	(0.38)	(0.44)	(0.45)	(0.18)	(0.23)	(0.69)	(0.51)	(0.21)
Constant	38.4909***	24.5691***	30.4991***	22.6503***	35.1675***	22.2093***	22.7338***	21.7627***
	(4.17)	(5.42)	(5.30)	(4.64)	(4.04)	(4.12)	(5.16)	(3.57)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	345	345	345	345	345	345	345	345
R-squared	0.487	0.481	0.482	0.478	0.478	0.461	0.458	0.462

*See text for variable definitions. T-statistic values, estimated using standard errors clustered by country, are in parentheses. *, **, and *** indicate significance at the 10-, 5-, and 1-percent levels, respectively.*

Tables 5, 6, and 7 also show the results of regressing future one-year exchange rate changes on the individual E, S, and G measures. As with the composite ESG measure, we generally find that individual E, S, and G measures are negatively and significantly related to future one-year exchange rate changes.

PREDICTING FUTURE TWO-YEAR EXCHANGE RATE CHANGES

Tables 8, 9, and 10 show the results of repeating the analyses shown in tables 5, 6, and 7, but to predict future two-year exchange rates instead of future one-year exchange rates. As before, we use a pooled regression to examine the relationship between the composite country ESG score and the percentage change in the exchange rate. To prevent serial correlation, we do not use overlapping time periods in the pooled regressions. Hence, we use only the years 2008, 2010, 2012, 2014, and 2016 (and therefore the sample sizes are smaller for these tests). Table 8 shows the univariate results, table 9 shows the results with controls (with the exception of interest rate differentials), and table 10 shows the results with controls including interest rate differentials. As before, tables 9 and 10 present results without and with PCA, respectively.

The results in the two-year case are similar to the findings in the one-year case. The results show that a country's ESG measure is negatively and significantly related to future two-year

Table 8

PREDICTING TWO-YEAR FUTURE EXCHANGE-RATE CHANGES WITH UNIVARIATE REGRESSIONS

Dependent Variable: Two-Year Future Percentage Change in Foreign Exchange Rate

(A): ESG factors				
ESG score	−3.8764***			
	(−3.55)			
E score		−2.7047*		
		(−1.76)		
S score			−1.9653***	
			(−3.25)	
G score				−3.3967***
				(−3.88)
Constant	31.3848***	23.8809**	22.2334***	28.3356***
	(4.30)	(2.44)	(5.27)	(4.50)
Year fixed effects	YES	YES	YES	YES
Observations	205	205	205	205
R-squared	0.303	0.286	0.285	0.323

(B): Control variables								
PPP Over (%)	0.0119							
	(0.75)							
ΔΔGDP (%)		−1.5939						
		(−1.56)						
ΔLn(GDP/ employee)			−3.6205					
			(−1.52)					
PCA				−2.5890				
				(−1.23)				
ΔInterest (%)					0.7947			
					(1.62)			
ΔΔMoney (%)						1.0999***		
						(3.73)		
ΔCurrent/GDP (%)							−0.7595***	
							(−3.75)	
ΔFDI/GDP (%)								−0.4920
								(−1.25)
Constant	7.5683***	14.2825***	4.9508*	9.3365***	2.3658	2.0925	11.1764***	7.1960***
	(3.07)	(2.71)	(1.85)	(3.54)	(0.87)	(0.86)	(4.73)	(3.12)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	205	205	205	205	163	205	205	205
R-squared	0.271	0.299	0.279	0.279	0.292	0.371	0.304	0.274

*See text for variable definitions. T-statistic values, estimated using standard errors clustered by country, are in parentheses. *, **, and *** indicate significance at the 10-, 5-, and 1-percent levels, respectively.*

Table 9

REGRESSION OF TWO-YEAR FUTURE PERCENTAGE CHANGE IN EXCHANGE RATE ON COMPOSITE ESG SCORE USING CONTROLS

Dependent Variable: Two-year in the Future Percentage Change in Foreign Exchange Rate

ESG score	−5.7391**				−6.5513**			
	(−2.65)				(−2.43)			
E score		−3.3498**				−3.7697**		
		(−2.03)				(−2.04)		
S score			−2.5248				−2.8590***	
			(−1.42)				(−2.75)	
G score				−2.9942**				−3.7348**
				(−2.13)				(−2.14)
PPP Over (%)	−0.0617*	−0.0302	−0.0169	−0.0389				
	(−1.84)	(−0.93)	(−0.78)	(−1.18)				
ΔΔGDP (%)	−2.4706**	−2.6376**	−2.6065**	−2.3316*				
	(−2.04)	(−2.19)	(−2.10)	(−1.97)				
ΔLn(GDP/employee)	−0.6247	−3.4208	1.4734	−0.7192				
	(−0.13)	(−0.58)	(0.22)	(−0.13)				
PCA					−10.2043***	−6.7734***	−8.0847***	−8.2341***
					(−2.95)	(−2.92)	(−3.43)	(−2.92)
ΔΔMoney (%)	1.1352***	1.1830***	1.2262***	1.1287***	1.0797***	1.1884***	1.1427***	1.0627***
	(3.90)	(3.75)	(4.12)	(3.58)	(4.13)	(4.56)	(4.05)	(3.78)
ΔCurrent/GDP (%)	−0.2697	−0.5259**	−0.4118*	−0.2078	−0.1717	−0.6680***	−0.4153*	−0.1313
	(−1.15)	(−2.09)	(−2.00)	(−0.72)	(−0.74)	(−3.32)	(−2.01)	(−0.46)
ΔFDI/GDP (%)	0.2605	0.3222	0.1563	0.1132	0.1564	0.3398	0.1269	0.0425
	(0.65)	(0.66)	(0.40)	(0.25)	(0.38)	(0.69)	(0.31)	(0.09)
Constant	50.4888***	31.9995**	33.1483**	31.2078***	45.4350**	28.6376**	26.4393***	27.5374**
	(3.16)	(2.59)	(2.14)	(2.86)	(2.58)	(2.25)	(2.95)	(2.34)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	205	205	205	205	205	205	205	205
R-squared	0.472	0.471	0.460	0.468	0.467	0.452	0.442	0.460

*See text for variable definitions. T-statistic values, estimated using standard errors clustered by country, are in parentheses. *, **, and *** indicate significance at the 10-, 5-, and 1-percent levels, respectively.*

exchange rate changes, both in the univariate analysis and the analysis with the control variables (without and with interest rate differentials). Hence, as the ESG score goes up, the USD declines, which implies that the local currency becomes relatively stronger.

However, note that the magnitudes of the negative coefficients are larger for the two-year prediction compared with the one-year case. For example, in table 10, column 5 (the two-year case), the coefficient on the ESG measure is −8.35, and in table 7, column 5 (the one-year case), the coefficient on the ESG measure is −3.54. Second, note that in table 8, ESG is a strong predictor of future two-year exchange rate changes, but many of the other controls, such as PPP Over, are not significant in predicting the two-year future exchange rates.

CONCLUSIONS

Traditional economic models of exchange rate prediction have fared so poorly in the short and medium time periods that practitioners have long taken to using technical analysis and momentum to predict exchange rate changes (see Menkhoff and Taylor 2007). Indeed, practitioners have utilized technical models since the removal of the Bretton Woods system. As an alternative to these economic and technical models, we

Table 10

REGRESSION OF TWO-YEAR FUTURE PERCENTAGE CHANGE IN SPOT EXCHANGE RATE ON COMPOSITE ESG SCORE USING CONTROLS AND INTEREST-RATE DIFFERENTIALS

Dependent Variable: Two-year in the Future Percentage Change in Foreign Exchange Rate

ESG score	−7.5244***				−8.3530**			
	(−3.01)				(−2.67)			
E score		−2.8418*				−3.6288*		
		(−1.82)				(−1.71)		
S score			−2.6991				−2.9395***	
			(−1.26)				(−2.98)	
G score				−2.8606**				−4.1201**
				(−2.05)				(−2.06)
PPP Over (%)	−0.0634*	−0.0161	−0.0101	−0.0250				
	(−1.80)	(−0.51)	(−0.43)	(−0.80)				
ΔΔGDP (%)	−2.6683*	−2.9201**	−3.0211**	−2.6522*				
	(−1.99)	(−2.22)	(−2.20)	(−1.99)				
ΔLn(GDP/ employee)	0.3027	−3.1013	1.2529	−0.6659				
	(0.05)	(−0.46)	(0.16)	(−0.10)				
PCA					−11.3363***	−6.5914**	−8.4225***	−8.4021***
					(−2.92)	(−2.58)	(−3.94)	(−2.77)
ΔInterest (%)	−0.0413	0.0937	−0.0760	−0.0438	−0.0446	0.2977	0.0016	−0.0035
	(−0.19)	(0.41)	(−0.37)	(−0.20)	(−0.17)	(0.81)	(0.00)	(−0.01)
ΔΔMoney (%)	1.2297***	1.2467***	1.3422***	1.2603***	1.1341***	1.1414***	1.1949***	1.1357***
	(3.68)	(3.21)	(3.65)	(3.43)	(3.44)	(3.17)	(3.40)	(3.24)
ΔCurrent/ GDP (%)	−0.3828	−0.5221*	−0.4384	−0.2916	−0.2402	−0.6607**	−0.4417	−0.1903
	(−1.38)	(−1.71)	(−1.58)	(−0.86)	(−0.83)	(−2.62)	(−1.62)	(−0.54)
ΔFDI/GDP (%)	0.0182	0.0807	−0.0474	−0.1553	−0.1206	0.2976	0.0550	−0.1816
	(0.03)	(0.13)	(−0.09)	(−0.27)	(−0.21)	(0.49)	(0.10)	(−0.31)
Constant	61.9243***	27.3267**	34.1023*	29.2483**	54.3967***	24.8596*	25.2345***	27.6875**
	(3.36)	(2.20)	(1.82)	(2.57)	(2.74)	(1.80)	(3.19)	(2.13)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	163	163	163	163	163	163	163	163
R-squared	0.487	0.476	0.471	0.474	0.474	0.444	0.437	0.456

*See text for variable definitions. T-statistic values, estimated using standard errors clustered by country, are in parentheses. *, **, and *** indicate significance at the 10-, 5-, and 1-percent levels, respectively.*

examined the ability of government ESG ratings to predict future one- and two-year exchange rate changes. Using the annual MSCI ESG Government Ratings from 2008 to 2018 for forty-two countries, we found a significant relationship between a country's ESG rating and the future change in the local currency. More specifically, we found that countries with higher ESG ratings have significantly better-performing currencies compared with countries with lower ESG ratings. We find this result when predicting exchange rates one and two years into the future. Our results are robust when including a variety of controls in the analysis.

Our findings suggest that ESG can be a helpful factor in predicting exchange rates over one- and two-year horizons. As to why they are helpful, we believe the best explanation is that they provide information that investors traditionally have not incorporated into currency values. For example, because investors may not understand the impact that labor has on a country's long-term prospects, they may underestimate how a country's ability to develop a healthy, productive, and stable workforce will influence its currency. Similarly, investors also may underappreciate the impact that a country's financial, judicial, and political systems have on its currency. By using

country-wide ESG information, currency investors can better incorporate this information.

We find that country-wide ESG ratings are significant predictors of future one-year and two-year exchange rates. Countries with high ESG ratings have significantly better-performing currencies compared with countries with low ESG ratings. These results suggest that investors may want to consider using ESG as a factor for predicting future exchange rate changes.

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ENDNOTES

1. Amel-Zadeh and Serafeim (2018) found the number of companies that report ESG data grew from fewer than twenty in the early 1990s to almost 9,000 in 2016.
2. For example, Fitch ESG Country Ratings covers 118 countries, Inrate covers 140 countries, Institutional Shareholder Services covers fifty-eight countries, Robeco covers 150 countries, Sustainalytics covers 167 countries, and Vigeo Eiris covers 170 countries (MSCI 2019, 7).
3. For a complete explanation, see MSCI ESG Government Ratings Methodology Handbook (2019).
4. Generally speaking, stronger and improving economic conditions in a country are expected to lead to foreign investment flows into the country, which should result in currency appreciation for that country, with weaker currencies expected for countries with poor or deteriorating economic conditions.
5. Note that we conducted our analysis on annual samples as well as the pooled sample. The annual samples are quite small (we have only forty-two countries or fewer per year), especially when we use all the control variables; so we only used the annual samples in the univariate analysis. Similar to the other results, we found a significant and negative relationship between ESG and future exchange rate changes in the majority of the years of our study.
6. Note that during our sample period of 2008–2018, the USD generally strengthened. Indeed, a critic of our study could suggest that the results are just an artifact of this fact. However, the USD weakened in 2009, 2012, and 2017, according to the US Dollar Index (DXY).

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