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Original Research

Do Stringent Environmental Policies and Business Regulations Matter for Economic Growth? Evidence from G7 and BRICS Economies

Nizamülmülk Güneş[1], Yilmaz Bayar[2] *, Marina Danilina[3], Omer Faruk Öztürk[4]

[1]Department of Audit, Savings Deposit Insurance Fund, Istanbul, Turkey
[2]Bandirma Onyedi Eylul University, Department of Public Finance, Bandirma, Turkey
[3]Plekhanov Russian University of Economics (PRUE) & Finance University under the Government of the Russian Federation, Moscow, Russia
[4]Uşak University, Department of Public Finance, Uşak, Turkey

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Abstract

The environment has received particular concern since the 1950s when countries began to experience the negative impacts of environmental degradation. This study employs cointegration and causality analyses to explore the influence of stringent environmental policies and business regulations on economic growth between 2000 and 2015 in the Group of Seven and BRICS economies. The causality analysis shows that business regulations have a significant effect on economic growth in the short run, while stringent environmental policies have no significant effects during that time. The cointegration analysis, however, reveals a mixed interaction among stringent environmental policies, business regulations, and economic growth depending country specific characteristics.

Keywords: stringent environmental policies, business regulations, economic growth, panel cointegration analysis, panel causality analysis

Introduction

Significant environmental degradation can be traced to economic growth, population growth, industrialization, urbanization, economic and social underdevelopment, and poverty dating back a long time. However, the damages caused by environmental problems have especially raised environmental concerns at both individual and country levels since the Second World War. In this context, the first world conference on the environment was conducted in Stockholm in 1972, and it was the beginning of the world's environmental management [1].

Climate change, ozone destruction and depletion, deforestation, decreases in biological diversity, acid rain pollution, land desertification, water and marine pollution, and toxic chemical pollution have been the main indications of raising environmental degradation in the world [2]. Environmental degradation is a serious threat to human health, biodiversity, and environmental survivability through direct and indirect exposure to such things as air pollutants and chemicals [3]. Therefore, countries, especially developed countries, have used stringent environmental measures such as

*e-mail: yilmazbayar@yahoo.com

environmental quality standards, environment taxes, and cap-and-trade policies to protect the environment in terms of legal and market-based solutions. Such stringent environmental measures can contribute to environmental protection, but they are also likely to raise production costs and decrease competitiveness [4]. Furthermore, stringent environmental regulations can lead countries to transfer their investments to countries with laxer environmental regulations.

In this context, environmental policies have benefits and costs for the countries. The limited number of empirical studies on the economic effects of environmental policies have revealed little impact of environmental policies on main economic variables, but considerable improvements in environmental quality. However, the economic effects are heterogeneous among sectors and firms in the countries [5]. We explore the impact of environment regulations together with business regulations on economic growth in sample of Group of Seven (G7) and BRICS (Brazil, Russia, India, China and South Africa) economies. The study targets to make a contribution to the relevant literature in three ways. First, the study will be one of the early studies analyzing the growth effect of environmental policies and business environment in view of the limited literature. Secondly, the research topic is analyzed in both G7 and BRICS economies, which are the main engines of the global economy with different country specific institutional, economic, and social characteristics. Thirdly, using the cointegration test with structural breaks in the empirical analysis gives us to reach relatively more-robust findings.

The G7 and BRICS economies are the leading economies with different institutional and economic structures in the globalized world. The BRICS economies represented 41.25% of the world's population and 23.05% of global real GDP as of 2020 [6, 7]. Furthermore, the BRICS economies have considerable land mass, natural resources, energy, and technological development [8]. On the other side, the G7 economies constituted 9.95% of global population in 2020 and 45.27% of global real GDP in 2019 [6, 7]. Most of the G7 and BRICS economies are among the 20 countries emitting the most CO_2 emissions [9]. Therefore, we explore the growth effect of environmental policies and business regulations in sample of G7 and BRICS economies.

The rest of the paper is structured as follows: The theoretical background and the related empirical literature on the research topic is respectively reviewed in next two sections and the dataset and method are then introduced. The empirical analysis of the interaction of stringent environmental policies, business regulations and economic growth is carried out in Section of empirical analysis. The paper comes to an end with a conclusion.

Theoretical Background

Environment sustainability is important for all living creatures. However, economic units should also continue the economic activities to survive and live more comfortably. Therefore, environment policies should make a contribution to environment sustainability, but also do not have significant negative effects on economic growth and development. Therefore, theoretical considerations and empirical findings on the effects and effectiveness of stringent environmental policies are critical for design and implementation of optimal environmental policies.

In the related theoretical literature, the Porter hypothesis, and pollution haven hypothesis have been the main theoretical studies on the effects of environmental policies. The Porter hypothesis suggests that environmental regulations encourage firms to make innovations, which in turn drive productivity gains [10, 11]. Such productivity gains can partially or fully meet the costs resulting from the stringent policies [12]. Furthermore, raising environmental quality because of more stringent environmental policies can increase environmental productivity and, also economic growth through raising productivity [13]. So, the net effect of stringent environmental policies on economic growth can vary, depending on the balance between the costs of environmental regulations and productivity gains driven by the innovation led by environmental regulations and better environmental quality.

The industrial flight and pull factor are two variants of the pollution haven hypothesis. The industrial flight suggests that pollution-intensive industries will move from the countries with higher costs of environmental compliance to the countries with lower costs of environmental compliance. The other variant suggests that the developing countries use lax environmental standards to attract foreign firms [14]. Therefore, relocation of the firms in different countries may negatively affect economic growth in the countries with stricter environmental regulations [15].

Business regulations also determine the environment in which the firms work [16]. Therefore, market-oriented business regulations can foster the economic growth through an environment encouraging private sector, and entrepreneurial activities.

Literature Review

In the empirical literature on environmental economics, the validity of the environmental Kuznets curve has been checked by many scholars such as Lijin et al. [17], Mosconi et al. [18], Osadume and University [19], Jardón et al. [20], and Castiglione et al. [21] as of 1990s, but their findings have been mixed, depending on the country or group of countries they studied, their method, and the duration of their study.

However, the effectiveness and economic effects of stringent environmental policies have not been studied in such detail, and the empirical studies have focused on the validity of the Porter hypothesis. Quite a few researchers have also explored the growth, employment and environmental effects of stringent environmental policies through cointegration and regression analyses, but their findings also have been mixed. In this context, Jorgenson and Wilcoxen [22] explored the growth effect of environment regulations in the US through a general equilibrium model and found a negative effect of environmental regulations on economic growth. Later, Jorgenson and Wilcoxen [23] discovered a negative effect of the 1990 Clean Air Act Amendments on economic growth. Ahmed and Ahmed [24] explored the interaction among the stringency of environmental policy, CO_2 emissions, and economic growth in China between 1970 and 2012. They found that stringent environmental policies negatively affected GDP. On the other hand, Cao et al. [25] explored the employment effect of environmental stringency in resource-based areas of China between 2000 and 2015 using dynamic regression. They discovered a positive effect of environmental regulations on employment.

Zhixin and Ya [26] researched the effect of carbon taxes on economic growth in provinces of China between 1999 and 2008 using regression analysis. They found a positive effect of carbon taxes on economic growth in eastern provinces and a negative growth effect in some provinces in the western and middle regions. The eastern provinces are economically more developed than the western and middle regions. Therefore, the western and middle regions depend on their abundant natural resources, and carbon taxes restrict economic growth there. On the other hand, Conefrey et al. [27] analyzed the growth effect of carbon taxes in Ireland and found a double dividend. Revenues from carbon taxes were recycled by the decreasing income tax revenues. Metcalf and Stock [28] explored the macroeconomic effects of carbon taxes and found no negative effect of carbon taxes on economic growth in the long run.

Some scholars have tested the validity of the Porter hypothesis, but their findings have been inconclusive. Cohen and Tubb [29] conducted a meta-analysis of 103 papers on Porter's hypothesis and discovered that support for the hypothesis was weak. In this context, Denison [30] explored the effect of air and water pollution measures on productivity in the USA and discovered a negative effect of environmental regulations on productivity. Jaffe and Palmer [31] analyzed the interaction between environmental regulations and expenditures for R&D and found that environmental regulations positively affected R&D spending in the US. Albrizio et al. [32] analyzed the effect of stringent environmental policies on the productivity of selected OECD countries at the industry and country levels. Their findings supported the Porter hypothesis. van Leeuwen and Mohnen [8] questioned the Porter hypothesis using industry-level data in the Netherlands between 2000 and 2008. They concluded that the Porter hypothesis was valid, but in a weak form. Feng et al. [33] also explored the influence of stringent environmental policies on industrial productivity in OECD countries using semi-parametric analysis. Their findings supported the Porter hypothesis.

Stringent environmental policies can also help to decrease the CO_2 emissions by encouraging firms to adopt cleaner technologies [34]. The related empirical literature disclosed that stringent environmental regulations decreased CO_2 emissions in line with theoretical considerations. Shapiro and Walker [35] explored the causes underlying the 60% decreases of air pollution emissions in the US manufacturing sector between 1990 and 2018. They showed that environmental regulations were the main factor behind the decreases in air pollution emissions. Wolde-Rufael and Weldemeskel [36] explored the influence of stringent environmental policies on CO_2 emissions in the BRICS countries, plus Indonesia, and Turkey, between 1993 and 2014. They discovered an inverted U–shaped interaction between those policies and CO_2 emissions. That is to say, stringent environmental policies decreased the CO_2 emissions after a threshold level. Wolde-Rufael and Weldemeskel [37] had similar findings for seven emerging economies. Demiral et al. [38] explored the determinants of CO_2 emissions in the 15 countries with the largest greenhouse gas emissions between 1995 and 2015, using regression analysis. They discovered that more stringent environmental policies did not help to reduce CO_2 emissions.

Last, the studies on the effect business regulations on economic have revealed a positive growth effect of a business-friendly environment in compatible with theoretical expectations. In this context, Messaoud and Teheni [16] explored the effect of business regulations on economic growth in a panel of 162 countries. They found a positive effect of indicators of the ease of doing business on economic growth. Conversely, Bonga and Mahuni [39] explored the effects of the ease of doing business on economic growth in members of the Africa Free Trade Zone and discovered that the ease of doing business had a positive effect on growth. Sebayang and Febrina [40] also analyzed the effect of the business environment on economic growth in ASEAN (Association of Southeast Asian Nations) and EU (European Union) members. They found a positive growth effect of business-friendly environments.

The recent studies on the impacts of stringent environmental policies and business regulations are displayed in Table 1. Those studies had mixed findings about the impact of stringent environmental policies on economic growth, but stringent environmental policies were effective in decreasing the CO_2 emissions. On the other side, the studies showed that market-oriented business regulations positively affected economic growth.

Table 1. Recent literature on environmental and business regulatory policies and economic growth.

Authors	Country	Time Period	Method	Results
Feng et al. [33]	8 OECD and 6 BRIICS (Brazil, Russia, India, Indonesia, China and South Africa)	1990-2015	Semi-parametric analysis	Porter hypothesis was valid.
Wolde-Rufael and Weldemeskel [37]	7 emerging economies	1994-2015	Augmented Mean Group estimator	An inverted U-shaped interaction between environmental policy stringency and CO_2 emissions.
Sebayang and Febrina [40]	ASEAN and EU members	2015-2019	Regression analysis	Business-friendly environment positively affected the economic growth.
Wolde-Rufael and Weldemeskel [36]	BRICS countries, Indonesia, and Turkey	1993-2014	Panel cointegration analysis	Environmental stringency policies decreased the CO_2 emissions after a threshold level.
Ahmed and Ahmed [24]	China	1970-2012	Grey dynamic model	Stringent environmental policies negatively affected the GDP
Bonga and Mahuni [39]	Africa Free Trade Zone members	2010-2016	Regression analysis	Ease of doing business indicators positively affected the economic growth.
van Leeuwen and Mohnen [12]	Netherlands	2000-2008	CDM (Crépon, Duguet, and Mairesse (1998) model	Porter hypothesis was valid at weak form.

Source: Authors' own elaboration

In this research, we analyzed the impact of both stringent environmental policies and business regulations on economic growth in developed countries proxied by the G7 economies and leading emerging economies proxied by the BRICS economies. Our research hypotheses are:

H_0: There is a significant cointegration relationship between stringent environmental policies and economic growth.

H_0: There is a significant cointegration relationship between business regulations and economic growth.

Data and Econometric Methodology

In this article, the effect of environment stringency policies and business regulations on economic growth was researched by employing a cointegration test [41] and a causality test [42]. In the econometric analyses, the growth rate of GDP per capita based on constant local currency was used as a proxy for economic growth. The stringency of environmental policies was represented by an index that ranged from 0 to 6 [43]. This index shows the extent to which environmental policies put a price on polluting or environmentally detrimental behavior (see [44], for details about how the index was constructed). The business regulations were represented by an index developed by the Fraser Institute [45]. It combined the costs of starting a business, bureaucracy costs, administrative requirements, bribes, extra payments, favoritism, licensing restrictions, and tax compliance. The business regulations index ranged from 0 to 10, and higher scores show business regulations that are more market oriented. The data sources are shown in Table 2. All the series were annual, and the study period was 2000-2015. This is because the annual business regulation index is available as of 2000, and the environmental policy stringency index already ends in 2015.

The G7 nations and BRICS economies formed our sample. The analyses were conducted using Stata 14.0 and Gauss 10.0 software. The dataset summary statistics were denoted in Table 3. The mean economic growth was 2.4% in the sample during the study period, but it showed considerable variations among the countries. On the other hand, the mean of the EPS index was 1.76, and the mean of the BUSREG index was 6.62 for the study period, and it showed fewer variations among the countries. However, the mean of the EPS index was 0.78 in BRICS economies, but was 2.45 in G7 countries. Furthermore, the mean of the BUSREG index was 5.24 in BRICS economies, but it was 7.61 in G7 economies. So, both the EPS index and the BUSREG index were much higher in G7 economies. In other words, G7 economies had more stringent environmental policies and more market-oriented business regulations when compared with the BRICS economies.

The primary aim of this research is to examine the effect of stringent environmental policies and business regulations on economic growth. The econometric analysis were conducted with three samples: Sample 1 included G7 and BRICS economies, Sample 2 consisted

Table 2. Dataset description.

Variables	Description	Source
GRW	GDP per capita growth based on constant local currency (annual %)	World Bank [46]
EPS	Environmental policy stringency index	OECD [43]
BUSREG	Business regulations index	Fraser Institute [45]

Source: Authors' own elaboration.

Table 3. Dataset's main characteristics.

Characteristics	GRW	EPS	BUSREG
Mean	2.40	1.76	6.62
Std. Dev.	3.37	1.09	1.45
Maximum	13.64	3.85	8.87
Minimum	-7.83	0.375	2.84

Source: Authors' own elaboration based on EViews 10.0 statistical package.

of the G7 economies, and Sample 3 included the BRICS economies. In the econometric model, GDP per capita growth rate stood for economic growth (GRW), and environment stringency policies (EPS) and business regulations (BUSREG) were proxied by an EPS index (EPS) and a BUSREG index, respectively. The following model was established for empirical analysis by following Ahmed and Ahmed [24] and Sebayang and Febrina [40]:

$$GRW_{it} = \alpha_0 + \beta_1 EPS_{it} + \beta_2 BUSREG_{it} + u_{it} \quad (1)$$

Stringent environmental policies have different effects on economic growth, depending on whether the positive or negative influence is greater, but market-oriented business regulations are expected to affect growth positively.

In the related literature, Wolde-Rufael and Weldemeskel [36, 37], Lazăr et al. [47], Jardón et al. [20], and many other scholars have employed panel cointegration analysis together with regression analysis to explore similar research topics. We prefer the cointegration test from Westerlund and Edgerton [41], the Augmented Mean Group (AMG) estimator, and the causality test from Dumitrescu and Hurlin [42], which takes into account the consequences of pre-tests and also provides country-level cointegration coefficients. Tests of cross-sectional dependency and heterogeneity were applied to further specify the econometric tests. Then, a stationarity analysis was conducted on the three series by way of cross-sectionally augmented IPS (CIPS; Im-Pesaran-Shin, [48]) and the unit root test [49] regarding cross-sectional dependency. The cointegration test from Westerlund and Edgerton [41] was used to determine the cointegration relationships between the EPS index, the BUSREG index, and economic growth. It showed there was cross-sectional dependency and the financial crises in the 2000-2015 period.

The Westerlund and Edgerton [41] cointegration test takes into consideration cross-sectional dependency, heterogeneity, structural breaks, autocorrelation, and heteroscedasticity. The statistic of cointegration test conducted with use of the following equations:

$$y_{i,t} = \alpha_i + \eta_i t + \delta_i D_{i,t} + x'_{i,t}\beta_i + \left(D_{i,t}x_{i,t}\right)'\gamma_i + z_{i,t} \quad (2)$$

$$x_{i,t} = x_{i,t-1} + w_{i,t} \quad (3)$$

D_{it} proxies the dummy variable, and α_i and β_i denote the constant and slope coefficients prior to the structural break, δ_i and γ_i denote the change after the structural break. z_{it} and w_{it} are the error terms. The endogenously determined structural breaks in the context of the cointegration test revealed significant effects from the global financial crisis and Eurozone sovereign debt crisis, and they supported the robustness of the cointegration test.

The causality among stringent environmental policies, business regulations, and economic growth was tested with the Dumitrescu and Hurlin [42] test. It was developed for heterogeneous panels, and it can produce robust findings in presence of cross-sectional dependency.

Empirical Analysis

For the empirical analysis, cross-sectional independency in the three models was first questioned by way of the Lagrange multiplier (LM), the Lagrange multiplier cross-sectional dependence (LM CD), and the LM_{adj}. tests [50-52]. The test results are in Table 4. Cross-sectional independency was rejected at the 1% significance level in the three samples, indicating a cross-section dependency.

Furthermore, the delta tilde tests of Pesaran and Yamagata [53] were applied to check for homogeneity in the cointegrating coefficient in all the models. The test results are in Table 5. Homogeneity was confirmed because the tests' probability values were found to be higher than 5% in all the models.

The integration levels of the three series in the three models were checked by Pesaran [49] CIPS unit root

Table 4. Cross-sectional dependency tests' findings.

Test	Model-1		Model-2		Model-3	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
LM	319.2	0.0000	133.3	0.0000	37.21	0.0001
LM adj*	42.46	0.0000	33.16	0.0000	11.88	0.0000
LM CD*	16.39	0.0000	11.13	0.0000	5.324	0.0000

*two-sided test

Source: Authors' own elaboration based on cross-sectional dependency tests' results.

Table 5. Homogeneity tests' findings.

Test	Model-1		Model-2		Model-3	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
$\tilde{\Delta}$	0.467	0.320	-1.384	0.166	0.388	0.698
$\tilde{\Delta}_{adj.}$	0.534	0.297	-1.599	0.110	0.448	0.654

Source: Authors' own elaboration based on homogeneity tests' results.

test, given the existence of cross-section dependence. The test results are in Table 6. The variables of GRW, EPS, and BUSREG were discovered to be I(1) in all the models.

The cointegration relationship among stringent environmental policies, business regulations, and economic growth in three models was questioned by the Westerlund and Edgerton [41] cointegration test. The test results are in Table 7. The results for the version that disregarded the structural breaks revealed no significant cointegration among stringent environmental policies, business regulations, and economic growth. However, the results for the version with level and regime shifts disclosed a significant cointegration among stringent environmental policies, business regulations, and economic growth for the three samples. Furthermore, the endogenously specified structural breaks denoted that the global financial crisis led a structural change

Table 6. Unit root tests' findings.

	Model-1			
Variables	Constant		Constant + Trend	
GRW	-0.952(0.241)		-1.146(0.187)	
d(GRW)	-5.372(0.000)***		-6.145(0.001)***	
EPS	-0.847(0.136)		-0.917(0.142)	
d(EPS)	-4.388(0.000)***		-5.214(0.000)***	
BUSREG	-1.249(0.258)		-1.315(0.277)	
d(BUSREG)	-7.392(0.000)***		-7.990(0.000)***	
Variables	**Model-2**		**Model-3**	
	Constant	Constant + Trend	Constant	Constant + Trend
GRW	-0.822(0.163)	-0.924(0.201)	-1.134(0.177)	-1.225(0.213)
d(GRW)	-8.427(0.005)***	-8.863(0.000)***	-9.461(0.000)***	-10.049(0.000)***
EPS	-0.953(0.153)	-1.016(0.180)	-1.052(0.314)	-1.172(0.370)
d(EPS)	-6.449(0.000)***	-7.257(0.000)***	-8.493(0.000)***	-9.306(0.000)***
BUSREG	-1.047(0.213)	-1.263(0.243)	-1.114(0.185)	-1.286(0.228)
d(BUSREG)	-5.386(0.000)***	-6.312(0.000)***	-9.225(0.000)**	-10.122(0.000)**

Source: Authors' own elaboration based on unit root test results.

Notes: *** it is significant at 1% significance level

in three models. The 2008 global financial crisis caused the distrust in the financial system to spread to other sectors of the economy [54]. The financial crisis decreased the effect of the banking sector and stock markets on economic growth [55]. Voskoboynikov [56] revealed that the financial crisis decreased the total factor productivity in Russia. Brazil, China, and the US experienced a similar situation in their economies. The capital flows had focused on the machinery and equipment before the crisis, but they concentrated on the construction sector after the crisis. In this regard, the structural break dates presented in Table 7 were important for indicating that the global financial crisis led to the structural breaks in the countries.

The cointegration coefficients were estimated by the AMG estimator of Eberhardt and Bond [57] and the Common Correlated Effects Mean Group (CCEMG) estimator of Pesaran [58]. Both estimators exhibited similar performance in terms of root mean squared error or bias in the panels with cointegrated or in Monte Carlo simulations [59]. The coefficients from AMG estimator only are in Table 8, because similar coefficients were obtained from two estimators.

The panel level cointegration coefficients of the first sample, which included G7 and BRICS economies, showed a positive growth effect of market-oriented business regulations, but stringent environmental policies did not have a significant effect on economic

Table 7. Westerlund and Edgerton [41] cointegration tests' results.

Model-1					
Model		P value		P value	
No shift	1.229	0.110	-1.705	0.044	
Level shift	-1.250	0.006	-1.257	0.004	
Regime shift	-1.780	0.038	-2.458	0.004	
Model-2					
Model		P value		P value	
No shift	-3.475	0.000	-3.863	0.000	
Level shift	-2.231	0.013	-4.386	0.000	
Regime shift	-1.453	0.073	-3.842	0.000	
Model-3					
Model		P value		P value	
No shift	-0.048	0.481	0.825	0.795	
Level shift	-1.229	0.010	-0.999	0.019	
Regime shift	0.204	0.082	0.983	0.011	
Country	Structural breaks (level shift)			Structural breaks (regime shift)	
	Model-1	Model-2	Model-3	Model-1	Model-2	Model-3
Canada	2007	2007		2007	2007	
France	2009	2009		2009	2009	
Germany	2009	2009		2009	2009	
Italy	2009	2009		2009	2009	
Japan	2009	2009		2009	2009	
UK	2009	2009		2009	2009	
USA	2009	2009		2009	2009	
Brazil	2009		2009	2009		2009
China	2007		2007	2007		2007
India	2010		2009	2008		2008
Russia	2009		2009	2009		2009
South Africa	2009		2009	2009		2009

Source: Authors' own elaboration based on cointegration test results.

Table 8. Cointegrating coefficients' estimation.

Model-1						
Country	EPS			BUSREG		
	Model-1	Model-2	Model-3	Model-1	Model-2	Model-3
Canada	-16.196***	0.780**		-0.407	-2.295**	
France	0.211	0.279**		0.923	-0.0181	
Germany	-1.899*	2.731*		0.901*	-0.224	
Italy	0.293	-0.143		1.376***	-0.427	
Japan	1.516	0.801*		1.610**	0.3597	
UK	3.554*	0.111		-0.435	-0.059	
USA	0.133	0.212		2.033**	0.278	
Brazil	1.073*		-16.056***	1.896**		0.909
China	-9.500**		-0.719	1.658**		1.085***
India	-0.421		5.1455***	0.076		0.3168
Russian Federation	0.011		-8.691*	2.265***		4.900***
South Africa	-0.723		-1.011**	1.8402		1.447**
Panel	-1.828	0.681*	-4.266	1.145***	-0.341	1.731**

Source: Authors' own elaboration based on AMG estimation results.
Notes: ***, **, and * is respectively significant at 1%, 5%, and 10%

growth. However, country level long run coefficients showed there was a negative growth effect of stringent environmental policies in Brazil, China, and Russian Federation, but a positive growth impact of stringent environmental policies in India. On the other hand, there was a positive growth effect market-oriented business regulations in France, Germany, Italy, Japan, Russian Federation, and the UK.

The cointegration analysis of the second sample, which included G7 economies, showed that stringent environmental policies positively affected the economic growth at panel level and in Canada, France, Germany, and Japan. However, business regulations had a significant negative influence on economic growth only in Canada.

The cointegration analysis of the third sample, which included the BRICS economies, disclosed that stringent environmental policies negatively affected the economic growth in Brazil, Russian Federation, and South Africa but positively affected the economic growth in India. Furthermore, business regulations positively affected the economic growth both at panel level and in China, Russian Federation, and South Africa.

The causality interactions of stringent environmental policies, business regulations, and economic growth in three models was tested following the method of Dumitrescu and Hurlin [42]. The findings are displayed in Table 9. The causality analysis denoted a significant causality from business regulations to economic growth only in the first model. In other words, business regulations had a significant effect on economic growth in the short term.

Results and Discussion

The causality and cointegration analyses were conducted to analyze the interaction among economic growth, stringent environmental regulations, and business regulations. The cointegration analysis on the relationship among stringent environmental policies, business regulations, and economic growth revealed a significant cointegration relationship among three variables for three samples of G7+BRICS economies, G7 economics, and BRICS economies.

The pollution haven hypothesis, and the Porter hypothesis have been mainly suggested to explain the interaction between environmental regulations and economic variables [60]. In this context, the stringent environmental regulations can cause some firms to move their location from their country to the countries with lax environmental regulations to avoid their costs [61]. However, lax environmental regulations may lead a country to become a pollution haven. On the other side, Porter [10] suggested that strict environmental regulations do not inevitably hinder competitive advantage, and often improve the competitiveness over time [62]. The proponents of the Porter hypothesis focus on the inefficient use of resources when environmental regulations are wrongly implemented, and oppose the

Table 9. Results of causality test [42].

Model-1			
Null Hypothesis	W-Stat.	Zbar-Stat.	Prob.
DEPS↛DGRW	2.47512	-0.17595	0.8603
DGRW↛DEPS	2.48651	-0.16549	0.8686
DBUSREG↛DGRW	**0.91696**	**-1.60721**	**0.0080**
DBUSREG↛DGRW	2.14396	-0.48014	0.6311
DBUSREG↛DEPS	0.95945	-1.56818	0.1168
DEPS↛DBUSREG	1.85452	-0.74601	0.4557
Model-2			
DEPS↛DGRW	0.75546	-0.59776	0.5500
DGRW↛DEPS	1.21945	-0.00355	0.9972
DBUSREG↛DGRW	0.35209	-1.11435	0.2651
DBUSREG↛DGRW	1.08372	-0.17738	0.8592
DBUSREG↛DEPS	0.31825	-1.15768	0.2470
DEPS↛DBUSREG	0.98521	-0.30353	0.7615
Model-3			
DEPS↛DGRW	0.64235	-0.62763	0.5302
DGRW↛DEPS	0.67337	-0.59406	0.5525
DBUSREG↛DGRW	0.62131	-0.65040	0.5154
DBUSREG↛DGRW	1.57307	0.37974	0.7041
DBUSREG↛DEPS	0.08918	-1.22635	0.2201
DEPS↛DBUSREG	1.30478	0.08936	0.9288

Source: Authors' own elaboration based on causality test results.

neo-classical view because it is too static to regard inefficiencies [63]. The Porter hypothesis is dynamic, because the implemented environmental regulations would affect the productivity and performance of the firms a few years after the innovation process is completed [62].

The cointegration analysis for the G7 economies revealed a positive a growth effect of stringent environmental policies in the long run and in turn support the Porter hypothesis in the G7 economies in the long run. In other words, the productivity gains from stringent environmental policies surpassed the cost of stringent environmental policies in G7 economies in the long run.

On the other hand, the cointegration analysis for the BRICS economies revealed a negative growth impact of stringent environmental policies in Brazil, the Russian Federation, and South Africa, but a positive growth effect in India. Therefore, the findings of BRICS economies contradicted the Porter hypothesis and showed that the countries have not offset the higher environmental costs and have not experienced the sufficient competitiveness to overcome the environmental costs considering the related theoretical considerations. However, the empirical results were consistent with the findings of Jorgenson and Wilcoxen [22, 23] and Ahmed and Ahmed [24].

Furhermore, the findings of the cointegration analysis also supported the pollution haven hypothesis for the BRICS economies because the countries can experience the improvements in environmental quality after a certain country-specific development level in view of the environmental Kuznets curve (EKC) hypothesis. Therefore, the environment of the less-developed countries is more polluted, while advanced countries experience improved environmental quality [64, 65].

On the other hand, the effect of business regulations on economic growth also was analyzed in sample of G7+BRICS economies, G7 economies, and BRICS economies through cointegration analysis. The cointegration analysis of the first sample including of G7 and BRICS economies disclosed a positive growth effect of the business regulations at the panel level and in China, France, Germany, Italy, Japan, the Russian Federation, and the UK in the long run. Then,

the nexus of business environment-growth was separately analyzed in sample of G7 and BRICS economies. The findings for G7 economies indicated that business regulations had a negative influence on economic growth only in Canada, but, the findings for BRICS economies showed a positive growth effect of market-oriented business regulations at the panel level and in China, the Russian Federation, and South Africa. The results were in line with the findings of Messaoud and Teheni [16], Bonga and Mahuni [39], and Sebayang and Febrina [40], which examined whether the business environment was a significant factor in economic growth.

The causality analysis among economic growth, environmental and business regulations showed that environmental policies had no significant effect on economic growth in the short run, but business regulations did affect economic growth. Therefore, the business environment may affect the economic growth in the short run in compatible with theoretical considerations. Furthermore, the empirical studies of the research were compatible with the findings of Messaoud and Teheni [16], Bonga and Mahuni [39], and Sebayang and Febrina [40].

Conclusions

Environmental awareness has increased considerably in the world in the past three decades, and countries have taken various environmental measures to eliminate the negative effects of economic development on the environment. Therefore, the effectiveness and effects of stringent environmental policies have been theoretically and empirically explored. On one hand, the Porter hypothesis suggests that environmental regulations encourage firms to make innovations that will lead to productivity gains and better environmental quality. On the other hand, the pollution haven hypothesis suggests that stringent environmental policy encourages firms to move their investments to countries with laxer environmental regulations. The empirical studies have yielded mixed findings in line with both theoretical and empirical considerations.

In this research, the effect of stringent environmental policies together with business regulations on economic growth have been analyzed in the G7 and BRICS economies from 2000 to 2015 through cointegration and causality analyses. The study period was limited with 2000-2015 period because business regulations score exists as of 2000 and environmental policy stringency index ends in 2015. The causality analysis showed that stringent environmental policies had no significant effect on economic growth, but market-oriented business regulations did have a significant effect on economic growth in the short run. On the other hand, the cointegration analysis disclosed that stringent environmental policies negatively affected economic growth in Brazil, the Russian Federation, and South Africa among the BRICS economies, but they positively affected economic growth in Canada, France, Germany, Japan, and India. So, the findings for the developed economies and India supported the Porter hypothesis, but the findings for the BRICS economies contradicted with it. The negative growth effect of stringent environmental policies in BRICS economies and a positive growth effect of stringent environmental policies in G7 economies also supported the EKC hypothesis. Furthermore, the market-oriented business regulations had a significant positive effect on economic growth, especially in China, the Russian Federation, and South Africa from BRICS economies by encouraging entrepreneurship and new firm entries to the markets.

Consequently, the governments of the BRICS economies can offset the rising environmental costs and decreasing competitiveness resulting from stringent environmental policies over time with an incentive policy that supports innovation and technological development, as seen in the developed countries. Furthermore, the study also shows that sustaining a business-friendly environment is important to support economic growth and development. Future studies can explore the economic effects of the design of environmental policies.

Conflict of Interest

The authors declare no conflict of interest.

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