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Is economic policy uncertainty detrimental to sustainability? Evidence from Asian countries

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Abstract

Despite the widespread recognition of the significance of long-term sustainability, there is as yet a relative paucity of evidence on what factors account for sustainability performance. In an effort to close the apparent gap in knowledge, this study contributes new empirical evidence to this discussion by considering the role of economic policy uncertainty. Inconsistent economic policy may undermine sustainability efforts as it creates a more complex and volatile operating environment, which, in turn, affects the behaviour of economic entities in the system. Drawing primarily on environmental management literature, this study aims to investigate the relationship between economic policy uncertainty and sustainability performance in the Asian regions between 2012 and 2020. With country-level annual data, this study estimates the model using a system generalised method of moments approach to address the possible biases resulting from serial correlation of random errors, simultaneity, and unobserved heterogeneity. Therefore, the estimates of this study will be consistent and asymptotically unbiased. The empirical analysis reveals that sustainability performance in Asia is adversely affected by economic policy uncertainty. The sustainability sub-components results are broadly in line with the main results that a higher economic policy uncertainty index is detrimental to the protection of natural capital and the development of social capital. This study concludes that ongoing economic policy uncertainty and disturbance could have serious repercussions for local economies, thereby hindering sustainability development. Overall, the findings of this study suggest that the establishment of sustainability development frameworks in areas of climate goals, social justice, and good governance would need to pay close attention to uncertainty in economic policy.

Keywords Economic policy uncertainty · Sustainability · Asia · The GMM estimator · Environment · Social · Governance

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1 Introduction

Nothing conveys the importance of sustainability more readily than climate change and its consequential extreme weather events that have become manifest in recent decades, like heat waves, more frequent floods and wildfires, and prolonged droughts. The immense environmental degradation caused mainly by the enormous amount of heat-trapping greenhouse gases is deemed to be particularly concerning, rightly infusing the ongoing global discourse on how to create more sustainable and equitable pathways for the future (Yang et al., 2022). As a response to stakeholders' rising concerns, across the world, there are intense efforts currently underway. Being one of the fast-industrialising countries, Vietnam, for example, is committed to making a plan for the carbon cap-and-trade system by the end of 2022 (Hoang, 2022), while China has pledged to generate 80% of its energy production from non-fossil fuel sources by 2060 (Bloomberg, 2021).

Despite the great interest it has garnered over the years, only a dearth of attention has been given to investigating sustainability performance in much empirical research. While it cannot be disputed that many researchers have made significant contributions to the field of environmental sustainability over recent years (see, for example, Adedoyin & Zakari, 2020; Ahmed et al., 2021; Yu et al., 2021a, 2021b), sustainability is not just a function of climatic conditions. It embeds a broader range of scopes, including social welfare and institutional governance, all of which are seamlessly integrated into a unified framework. While environmental considerations pervade a larger part of the community, achieving the Sustainable Development Goals (SDG, hereafter) requires managing many fundamental aspects—the economy, society, natural environment and resources, and governance (United Nations, n.d.). This, in turn, highlights that sustainable development planning necessitates a strategic roadmap that not just reduces exposure to climate risk but also achieves positive impacts on society and governance. For the paucity of empirical evidence, rather than capturing sustainability considerations by environmental quality, this study delves deeper into the analysis of sustainability performance which is still missing in the literature so far, to the best knowledge of the researchers.

Yet this limitation is not solely related to the number of research studies. To expand knowledge and address sustainability challenges effectively, there is an urgent task ahead to demand more details by identifying key threats to sustainable development. Uncertainty about economic policies may be a significant impediment to the implementation of sustainability programmes, particularly in Asian countries, which have demonstrated varying levels of commitment towards supporting sustainability. Based on existing literature, economic policy uncertainty (EPU, hereafter) may change the business environment in addition to its profound economic impacts (Amin & Dogan, 2021). It has such a significant influence on the real economy that it shapes the economic outcomes by affecting the behaviours of both the public and private sectors directly and indirectly. It resembles the concept of risk that is generally described as economic entities' incapability to anticipate changes in macroeconomic policies and its implementation, particularly those involving monetary and fiscal decisions (Pirgaip & Dinçergök, 2020). When the path forward—the timing, substance, and consequences of policy changes—is unclear (Gulen & Ion, 2016), perceived threats emerge, and firms will start to take a "wait and see" approach to long-term investments (Bloom, 2009), such as those pertaining to energy conservation equipment and climate technologies. Given that decisions might go wrong and there are trade-offs, the entities may be more cautious while exploring and evaluating their alternative actions. As a consequence, environmental health deteriorates when the EPU index rises (Adedoyin & Zakari, 2020; Yu et al., 2021a, 2021b).

Concerning the sustainability performance of a nation, the belief in this postulation appears rational in explaining how they are intertwined in comparable ways. In the analogous context, policies promoting anti-corruption, eliminating mass poverty, and improving human capital for greater equity may become less predictable, and as a result, these initiatives could be put on hold, and that the public resources formerly earmarked for social good and governance efficiency may be shifted to other priority areas. This means that EPU will possibly be deeper and broader in impact, undercutting the sustainability achievements. For the first time in the literature, this study aims to investigate the relationship between EPU and sustainability performance in the Asian regions during the 2012–2020 period.

This study makes three significant contributions. First, this study entails addressing issues that have been neglected in research work, especially those related to sustainability performance. The ideology of sustainability seems to have gained traction exponentially in recent years, but the body of related research has failed to catch on. On the specific issue of environmental health, for instance, scholarly efforts were keenly directed at studying the influence of EPU in mitigating pollution (see, for example, Khan et al., 2022; Liu & Zhang, 2022; Xin & Xin, 2022; Wen & Zhang, 2022). This obviously does not fully capture sustainable standards, which is a leading cause of gaps in the discussion on EPU and sustainability. This study highlights the need to take a more holistic approach to sustainable development so as to ensure inclusive growth and development for all people through multifaceted sustainability programmes. Doing so not only offers insights into the larger context of efforts to build a sustainable and resilient future but also aids in the scaling up of transformation.

To further illuminate the pathway to sustainable development, second, this study sheds light on the impacts of EPU on natural capital, social capital, and governance efficiency, respectively. Achieving sustainability primarily requires success in the three main pillars, that is, the environment, society, and governance (ESG). This makes it imperative for any ensuing discussion to focus on creating long-term value by addressing these daunting challenges. Empirical evidence from this study is important since EPU can have adverse effects on all the sub-components of sustainability in various ways, either because initiatives in certain areas are more susceptible to EPU than others are or policymakers and economic entities respond differently to the level at which EPU is. This study is expected to provide a much-needed analytical results that could serve as a catalyst to mitigate the effects of climate change, reduce socio-economic vulnerability, and enhance governance standards in a cohesive way.

Third, with a strong emphasis on sustainability in the Asia regions, this study is part of pioneering work in cross-country analysis to assist governments in formulating coherent policies and strategic plans that address regional needs while also fulfilling the SDGs. Though there has been tremendous progress made by many countries in accelerating sustainable development in recent decades, large variation still persists between countries. Many developing countries in this region are still overshadowed by economic concerns and confronted with numerous challenges. Individual governments, which have been under increasing pressure to account for uneven economic recovery and growth setbacks arising from the COVID-19 pandemic, will find it particularly challenging to prioritise sustainability issues (Hope, 2022). Coupled with EPU, which may impede the progress of the transformative change, it is high time to conduct this study.

Using cross-country data from 38 countries, this study provides some initial insights into the factor influencing sustainability performance by considering the impact of EPU.

The rest of this paper is structured as follows: Section 2 is the literature review and hypothesis development. Section 3 includes an overview of the empirical approach, data sources, and the definition of key variables. The empirical results are presented in Section 4, and the conclusion and policy implication are discussed in Section 5.

2 Literature review and hypothesis development

2.1 Sustainability

Economists have been of the view that efficient use of resources is necessary as natural capital is scarce, non-renewable, and exhaustible. This concern has led to a vast outpouring of literature concerning the sustainability of human ecological systems, particularly in terms of how long they will continue to be productive. Sustainability, defined as "a characteristic of a process or state that can be maintained at a certain level indefinitely" (Misra, 2008, p. 847) is deemed imperative for long-term growth and progress. It calls for a development process that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations General Assembly, 1987, p. 43). From this standpoint, Basiago (1998) explained that sustainability is about maintaining an entity, outcome, or process through the passage of time. More specifically, it is concerned with the efficient and equitable allocation of resources for both current and future generations within a finite ecosystem (Stoddart, 2011).

Considering sustainability in the context of a country, like those previously referred to, it is about generating and sustaining inclusive wealth that does not adversely affect the capacity of the country to sustain or increase its current wealth levels in future (SolAbility Sustainable Intelligence, n.d.). This is most obvious in the attempts to realise sustainability through economic progress, human development, and institutional safety and well-being (Robert et al., 2005). Yang et al. (2022) suggested that achieving sustainability requires considerable coordinated and cooperative efforts among ESG practices. In turn, this calls for present efforts that consider human development, environmental sustainability, and governance to be consistent to meet future as well as present needs (Opoku et al., 2022; Salo et al., 2022). They are both interdependent and integrated, requiring comprehensive approaches to cope with sustainability challenges. As a whole, sustainability is viewed as a future-oriented philosophy guided by the principles of ecology, justice, and biodiversity.

2.2 Economic policy uncertainty

Economic policies are crucial to the smooth functioning of the economy from many angles, among which are accelerating growth, improving the quality of human lives, and supporting environmental health. Economic policies, uncertainty about policies, and the eventual economic outcomes are all inextricably entwined, as identified through the abundance of extant literature in this domain (see, for example, Baker et al., 2016; Gulen & Ion, 2016; Wang et al., 2022; Zakari et al., 2021).

In terms of economic policies, they can be described as specific tools for achieving economic goals, but frequent policy changes are often accompanied by more confusion and disruption (Amin & Dogan, 2021), which could wreak havoc and even have serious repercussions for local economies. The importance of EPU for economic outputs has begun to gain enormous attention from scholars, policymakers, and practitioners ever since the seminal work of Baker et al. (2016), who developed an EPU index based on newspaper coverage frequency. As stated in their study, EPU is broadly defined as uncertainty over the future pertaining to a government's fiscal, monetary, and regulatory policies. According to Gulen and Ion (2016), EPU arises when there are variations in macroeconomic policies and their implementation. It has been observed from several perspectives that the key decisions made within such a situation always bring new requirements that compel economic agents to respond quickly, and hence the outputs may not be reasonably estimated. In other words, when economic entities are unable to accurately predict both the timing and possible effects of policy changes (Abakah et al., 2021; Ashraf & Shen, 2019; Danish et al., 2020), they need to make strenuous efforts to deal with more complex challenges in an increasingly volatile operating environment. Overall, certain recent decisions, such as those pertaining to tax reforms, spending cuts, healthcare budgets, and interest rate hikes have resulted in more turbulence and increased risks to the global economy (Altig et al., 2020; Baker et al., 2020; Tang et al., 2021; Zakari et al., 2021).

There are a wide range of arguments that have been posited in favour of stable and consistent economic policies. In order to grapple with sustainability challenges, EPU is considered crucial in influencing the conduct of the three core sectors: businesses, governments, and households (Al-Thaqeb & Algharabali, 2019; Danish et al., 2020; Wang et al., 2022). Given that climate change issues remain the core element of discussion around EPU (see, for example, Adedoyin & Zakari, 2020; Ahmed et al., 2021; Jiang et al, 2019; Shabir et al., 2022) and there are admittedly limited studies available on sustainability performance at the macro level, the perspective of this study is based on other important parts of EPU and environmental damage, which have now appeared in leading sustainability discussions.

Corporations play an unequivocal role in the economic system. Equally important, it may be well that they can play an especially influential part in industrial green transformations. Significant progress in this area will depend on continuing efforts and sustained engagement of business entities in the scope of green innovation and technological advancements. There are numerous benefits including improved operational efficiency, more production of eco-friendly goods and services (Hussain & Dogan, 2021), reduced carbon emissions, and the acceleration of adoption of clean energy innovation (Lee & Min, 2015). However, EPU will have wide-reaching implications for corporations. To illustrate, when encountering higher EPU, the industries and firms will review and defer all investment decisions (Ulucak & Khan, 2020). The empirical results by Chen et al., (2019) underscore that EPU has a significant negative effect on firms' short-term, long-term, and total firm investments in the United States (the U.S.). A compelling explanation was offered by Gulen and Ion (2016), who argued that corporations which fear investment irreversibility are reluctant to make crucial and long-term investments, thereby missing out on potential opportunities for new investment projects. Moreover, firms suffer and need to spend unnecessary resources in ambiguous and unstable conditions under which such businesses are carried on. When corporations have doubts about the cost of doing business due to uncertainty in policies, they become aggressively guarded with their investment plans (Kang et al., 2014), and firms may subsequently increase their proportion of funding liquidity to better deal with uncertainties (Zhao & Su, 2022). Overall, EPU has a considerable bearing on business risk and strategy.

In addition to investment decisions, EPU has a significant impact on the extent to which companies engage with sustainability initiatives under the funding channels. As discussed in prior studies, EPU could presage more funding problems by limiting bank loan availability as credit risks grow (Bordo et al., 2016; Chi & Li, 2017; Çolak et al., 2017; Wang et al., 2022). It seems to make sense that having difficulty accessing financing resources may severely limit the capabilities of enterprises to invest in green technologies (Andersén, 2017; Yu et al., 2021a, 2021b). A thorough investigation of literature reveals that together with reduced funding opportunities and bank credit restrictions due to factors such as stock illiquidity (Wang et al., 2021), a higher cost of capital (Ashraf & Shen, 2019; Liu & Wang, 2022; Xu, 2020), and a tightening credit environment (Bordo et al., 2016), the supply of investment capital shrinks, and innovation productivity is impacted as a consequence (William & Wang, 2022; Zhou et al., 2022).

By way of another example, if technological innovation is wrought by technological investments, the study by William and Wang (2022) is relevant. Their main findings demonstrate that EPU impedes innovation via the risk-tolerance, financial, and information channels. In particular, firms that are risk-averse will cut spending in risky innovation projects when information becomes asymmetry and capital is less readily available during periods of increased uncertainty. This means that a dip in innovation outcomes will not be beneficial to the environment. Attention to their study enables exploration of the way that EPU shapes sustainability performance in this study.

Subject to transformations towards sustainability, there is relatively minor controversy about the emphasis to be placed on national governments that formulate sound economic policies. They must play an effective role in supporting such activities while internalising environmental externalities (Qin et al., 2019). It is soberly acknowledged that public policies and development programmes are instrumental not only in improving the quality of life for individuals (Drolet & Sampson, 2014; Gates, 2018; Ng et al., 2020), but also reducing pollution (Chen et al., 2022a, 2022b; Zhang, 2022). In this context, EPU is considered relevant. Jiang et al. (2019) explained that in the face of increasing policy uncertainty, enterprises generally anticipate that regulatory priority will shift away from environmental governance to other more immediate concerns. In response, companies may decide to pay less attention to environmental initiatives. It has already been demonstrated by Zhong et al. (2022) that when local governments face enormous economic pressure, they are less likely to adhere to high standards of environmental practices. And indeed, corporations will usually follow suit by cutting back on efforts to protect environments, especially in eco-friendly investments. As one might expect, Amin and Dogan (2021) reported that carbon dioxide (CO_2, hereafter) emissions increase with an increase in the EPU level in China.

EPU can affect sustainability performance via a consumption channel. This means that customers who are willing to purchase more green products are more likely to put pressure on companies to make their manufacturing operations more environmentally friendly. Nonetheless, EPU causes changes in household income, which in turn affect their decisions on consumption, expenditure, and savings (Nakhli et al., 2022). As household consumption is depressed in times of elevated EPU (Bloom et al., 2007; William & Wang, 2022), according to Adedoyin and Zakari (2020), firms will revise and delay their investment decisions. Therefore, it can be argued that a decline in the investment of enterprises in green technology innovation projects is indicative of deteriorating environmental performance during a period of EPU.

A summary of the literature review related to EPU and environmental sustainability performance is presented in Table 1.

As with other initiatives to improve environmental health, maintaining consistency in policy development and implementation is important to create a more conducive business environment, which could lead to businesses propelling sustainability in their operations.

Table 1 Summary of literature review related to EPU and countries' environmental sustainability performance

Authors	Samples	Methods	Key variables	Key findings
Adams et al. (2020)	10 resource rich countries, 1996–2017	Panel Pooled Mean Group—Augmented Autoregressive Distributed Lag (ARDL)	CO_2 emissions, EPU, economic growth, energy use, and geopolitical risk	There is a relationship between EPU and CO_2 emissions in the long run
Adedoyin and Zakari (2020)	the United Kingdom, 1985–2017	ARDL cointegration technique	CO_2 emissions, EPU, economic growth, and energy use	EPU reduced the growth of CO_2 emissions in the short run
Ahmed et al. (2021)	the USA, 1985–2017	Symmetric and asymmetric ARDL approaches	CO_2 emissions, EPU, economic growth, public renewable energy research and development budgets, and FDI	A positive change in EPU reduced CO_2 emissions
Amin and Dogan (2021)	China, 1980–2016	Dynamic ARDL simulations	CO_2 emissions, EPU, economic growth, energy intensity, energy structure, and population	EPU caused CO_2 emissions
Anser et al. (2021)	Five emerging nations, 1995–2015	Fully modified and dynamic ordinary least square (OLS) estimators, panel Granger causality	Ecological footprint, economic growth, energy consumption, EPU, and geopolitical risk	EPU has a positive relationship with ecological footprint
Borojo et al. (2022)	112 developing countries, 2000–2019	Generalised Method of Moments (GMM) technique	CO_2 emissions, EPU, economic growth, institutional quality, government expenditure, and FDI	There is a positive relationship between EPU and CO_2 emissions
Chen et al. (2021)	15 countries, 1997–2019	Cointegration test, fixed effect model	CO_2 emissions, EPU, economic growth, and FDI	EPU negatively affected CO_2 emissions
Farooq et al. (2022)	Brazil, Russia, India, China, 2000–2019	Fully modified and dynamic ordinary least square (OLS) estimators	CO2 emissions, EPU, economic growth, financial development, natural resource rent, and FDI	EPU has a positive impact on CO_2 emissions
Nakhli et al. (2022)	the USA, 1985–2020	Bootstrap rolling approach	Carbon emissions, EPU, renewable and non-renewable energy	Bidirectional causality between CO_2 emissions and EPU
Su et al. (2022)	137 countries, 2001–2018	GMM technique	Environmental performance index, EPU, economic performance, FDI, green technologies, urbanisation, ageing, and international trade	EPU has a negative effect on environmental performance

Table 1 (continued)

Authors	Samples	Methods	Key variables	Key findings
Xue et al. (2022)	France, 1987–2019	ARDL cointegration technique	CO_2 emissions, EPU, economic growth, urbanisation, and technology	Causality from EPU to CO_2 emissions

Building on the aforementioned insights, there is a clear suggestion that EPU is related to sustainability performance.

3 Methodology and data

3.1 Econometric method

This study is part of a growing literature on the effects of EPU in the sustainability domain. Despite the increasing importance of sustainable development, existing studies delineating the impact of EPU on sustainability performance are scarce, and this is considered one of the most significant challenges for this study in the process of research model development. Given the lack of literature review on the alleged link between EPU and sustainability, this study draws insights from academic works on the relationship between EPU and environmental health (see, for example, Adedoyin & Zakari, 2020; Jiang et al., 2019; Shabir et al., 2022; Su et al., 2022), which have illustrated uncertainty around economic policy is always a determining factor of carbon emissions across countries (Amin & Dogan, 2021; Zakari et al., 2021).

A study by Ng et al. (2020) on the ESG performance in Asia could provide a basis for knowledge and a practical foundation to investigate sustainability in this research. Extending their work and following other important studies such as Adams and Acheampong (2019), Borojo et al. (2022), Sharma (2011), Su et al. (2022), and Zhou and Xu (2022), this study employs the two-step system Generalised Method of Moments (GMM) model to test the regression model. For testing the hypothesis, a regression model is appropriate since it determines how changes in sustainability performance are related to changes in EPU. Regarding the use of the GMM technique, the advantage of this method is that it controls for serial correlation of random errors, simultaneity, and unobserved heterogeneity, which in turn results in a greater efficiency gain with consistent and unbiased estimates (Arellano & Bover, 1995). This method of analysis eliminates unobservable national heterogeneity that may affect EPU and sustainability performance. In addition, it is reasonable to assume that the independent variables identified for this study are not strictly exogenous. For example Canh et al. (2020) found that the domestic growth rate of *EPU* is negatively related to *FDI*. In this condition, where the variables are correlated with past and possibly current realisations of the error, the system GMM model is more suitable to overcome this problem (Roodman, 2009).

The general dynamic linear model is depicted as follows.

$$S_{i,t} = \sigma_0 + \sigma_1 S_{i,t-1} + \sigma_2 EPU_{i,t} + +\sigma_3 GDP_{i,t} + \sigma_4 TRADE_{i,t} + \sigma_5 FDI_{i,t} + \sum\nolimits_6^{t+4} \sigma_b TIME_i + \varepsilon_{it}$$

where $i = 1, 2, 3\ldots 38$; $t = 1, 2, 3\ldots 9$, S is the sustainability performance for the ith country at the time t, and σ_0 is the intercept. $S_{i,t-1}$ is the 1-year lagged value of the dependent variable, which allows for the modelling of a partial adjustment mechanism. The inclusion of this variable is to capture the persistence of sustainability performance in the model. The explanatory variable is EPU (*EPU*) while the control variables are gross domestic product (*GDP*) per capita, in constant 2015 prices, expressed in U.S. dollars, trade openness is the total of exports and imports of goods and services, expressed as a percentage of GDP (*TRADE*), net inflows of FDI, in % of GDP (*FDI*), and time dummies (*TIME*) (see, for example, Amin & Dogan, 2021; Borojo et al., 2022; Ng et al., 2020; Xue et al., 2022;

Zakari et al., 2021). ε_{it} is the disturbance term. When estimating variables, their natural logarithm forms are used.

To determine whether the instruments are valid, the Sargan test, which evaluates over-identification restrictions, and the Arellano–Bond test, which measures the absence of serial autocorrelation, are used. The study by Arellano and Bover (1995) provides an in-depth elaboration of the GMM estimator.

For the purpose of testing robustness, the same regression models are tested with alternative dependent variables, namely natural capital, social capital, and governance, respectively. They are the core measures of sustainability performance in the context of ESG. According to Yang et al. (2022), there is growing literature that supports the use of ESG scores as a measure of sustainability performance. Comparing the results of the analysis with different proxy indicators of sustainability is necessary not only to obtain robust evidence but also to formulate a more specific and effective policy that will improve sustainable development in these three dimensions. With this, practitioners and policymakers will be able to draw useful conclusions from such estimations when deciding how to organise their sustainability initiatives.

3.2 Data and variables

The data used in this study comes from a variety of sources, depending on the indicator and the availability of data. Table 2 describes how the variables are defined and measured. The dependent variable of this study is sustainability performance (*S*), proxied by the SolAbility's Global Sustainable Competitiveness Index (GSCI, hereafter), which was developed and published since 2012. The GSCI is an important country sustainability indicator that includes a wide variety of ESG principles in decision-making for countries and organisations. It takes into account a total of 131 data indicators gathered from the World Bank, the International Monetary Fund (IMF), as well as other United Nations (UN) agencies.

The sustainable competitiveness model is based on three dimensions, namely the governance, the environment, and the society. It conveys important information regarding the extent to which a country's activities are sustainable in five areas: (1) natural capital, (2) social capital, (3) intellectual capital, (4) resource management, and (5) governance efficiency. As shown in Table 2, each is composed of a different number of relevant indicators. Since there is no "best" in absolute terms, in order to produce the sub-indices, raw data are analysed and ranked individually for each indicator based on the sustainability pyramid. Following the calculation of the average deviation, the top 5% receive the highest score (100), and the bottom 5% receive the lowest score (0). Accordingly, the scores between the highest and the lowest 5% are linearly assigned. Following that, an equal weighting is applied to each of the sub-indices that make up the GSCI. In a nutshell, this index measures a country's sustainable development progress by considering the current and future ability of a nation to generate and/or sustain such wealth both now and in future (SolAbility Sustainable Intelligence, n.d.). A high GSCI indicates high sustainability performance.

To investigate the relationship between EPU and sustainability performance, this study uses the World Uncertainty Index (WUI) as the proxy (see, for example, Adams et al., 2020; Borojo et al., 2022). The WUI is calculated by counting the number of words referring to uncertainty (or its variants) within the Economist Intelligence Unit country reports. The WUI is further normalised by total number of words rescaled by a factor of 1,000. As the number increases, so does the level of uncertainty.

Table 2 Definition of variables

Variables	Definition	Source
Sustainability performance (*S*)	The concept of sustainable competitiveness refers to a nation's ability to meet the needs and basic requirements of current and future generations without destroying social and natural environments This index is calculated using a sustainable competitiveness model, which consists of 131 data indicators grouped into five categories: natural capital, resource intensity, social capital, governance efficiency, and intellectual capital. This score is based on a zero to 100 scale (SolAbility Sustainable Intelligence, n.d.)	SolAbility
Natural capital (*NC*)	Natural capital refers to the physical environment and climate conditions of a nation. The calculation of natural capital scores involves 24 indicators including indicators for water (average rainfall, renewable freshwater availability), forests, biodiversity, agriculture, land degradation and desertification, minerals and energy resources, pollution, and depletion. This score is between zero to 100 (SolAbility Sustainable Intelligence, n.d.)	SolAbility
Social capital (*SOC*)	It is about social well-being and stability of a country. Nations and societies must strive for social cohesion, coherence, and unity among all to promote economic stability. There are 29 indicators, including health performance indicators (health care efficiency), birth statistics, income disparities, equal opportunity, crime rates, freedom of press, respect for human rights, and perceived levels of well-being and happiness. This score is from zero to 100 (SolAbility Sustainable Intelligence, n.d.)	SolAbility
Governance (*G*)	The governance efficiency index encompasses all aspects affecting the structure of society and the economy. Indicators of governance include business legislation, corruption levels, government cohesion, cyber defence readiness, exposure to business and volatility risks, and financial exposure. The index is characterised by 28 indicators. This score is based on a zero to 100 scale (SolAbility Sustainable Intelligence, n.d.)	SolAbility
Economic policy uncertainty (*EPU*)	The EPU's proxy is WUI. It is calculated by counting the number of words referring to uncertainty (or its variants) within the Economist Intelligence Unit country reports. The index is further normalised by total number of words and rescaled by a factor of 1,000 (Baker et al., 2016)	WUI
Economic development (*GDP*)	Gross Domestic Product (GDP) per capita is constant 2015 prices, expressed in U.S. dollars (World Bank, 2022)	WDI
Trade openness (*TRADE*)	The trade openness can be defined as the sum of exports and imports of goods and services as a percentage of GDP (% of GDP) (World Bank, 2022)	WDI
Foreign direct investment (*FDI*)	It is calculated as net inflows of FDI (% of GDP) (World Bank, 2022)	WDI
Time dummies (*TIME*)	Time dummy variables that correspond to years for the 2012–2020 period	self-developed

The methodology development of GSCI, which includes the natural capital, social capital, and governance performance indicators, is available in the Sustainable Competitiveness Report (2021)

To obtain more robust and accurate results, this study employs a set of control variables commonly accepted as key determinants of sustainability in prior studies. They are economic development, trade openness, foreign direct investment (see, for example, Ahmed et al., 2021; Chen et al., 2021; Su et al., 2022), and temporal dummies. The measurement of variables is in general consistent with previous research that preceded it, particularly that of Borojo et al., (2022) and Ng et al. (2020) and the data are retrieved from the World Development Indicators (WDI) by the World Bank. The following is a brief explanation for including the control variables.

In line with other studies in this field, real GDP is the proxy for economic development (Adams et al., 2020; Amin & Dogan, 2021; Xue et al., 2022; Zakari et al., 2021). It is believed that economic development is paramount to promote social inclusion by increasing the quality of life (Donou-Adonsou & Sylwester, 2016; Shahbaz et al., 2016). This is because during economic expansion, manufacturing firms are more likely to ramp up production to satisfy higher demand, creating more employment opportunities that are beneficial to poverty alleviation. According to Shafik and Bandyopadhyay's (1992) empirical study, the problems of urban sanitation and the availability of clean water both decrease with an increase in income. Likewise, a rise in income induces a rise in spending on green technologies (Grossman & Krueger, 1995) and promotes technological advancement, which impacts the efficiency of inputs and outputs as well as the level of ecological development (Zhou & Xu, 2022). In explaining the economy-environmental health nexus, Georgescu-Roegen (1971) and Daly (1977), however, pointed out that when income rises, it results in increased consumption and production of goods, which may contribute to pollution. On this view, GDP was empirically reported to have a positive relationship with environmental degradation (Al-Mulali et al., 2015; Omri et al., 2015; Sehrawat et al., 2015; Tamazian & Rao, 2010). In short, previous studies looking at the impacts of GDP had produced conflicting results.

Trade openness is expected to have beneficial and detrimental environmental consequences. It has the potential to boost output and revenue, and as a result, it has impacts on emissions due to the scale and the technique effects (Antweiler et al., 2001). For example, a growth in output is predicted to produce more pollutants, but the use of environmentally friendly tools and equipment as wealth grows will be beneficial to environmental quality due to the technique effect (Dogan & Turkekul, 2016). Considering this postulation, the findings of Ang (2009), Grossman and Krueger (1995), Cole and Elliott (2003) and Omri et al. (2015) support that an increase in foreign trade resulted in poorer quality of environment. Meanwhile, Managi (2009) showed empirically that the effect of trade openness is inconclusive, varying by countries and type of emissions.

FDI is generally used as a measure of economic openness in studies of environmental quality (Chua, 1999; Jalil & Feridun, 2011). In line with previous studies, net inflows of FDI (% of GDP) are postulated to promote sustainability, primarily due to "the transfer of know-how, technological innovation, the reduction of poverty, the payment of a relatively higher salary and contribution to creating jobs and boosting exports" (Abid, 2017, p. 184). Similarly, Ng et al. (2020) asserted that foreign investors are likely to give high priority to sustainability, transparency, and governance, and as a result, local governments are believed to pay greater attention to sustainability issues when foreign investment firms are present. In terms of environmental health, however, FDI creates growth opportunities for businesses that, in turn, result in high energy demands which increase emissions of CO_2 (Lee & Brahmasrene, 2013; Zhang, 2011). As a whole, the impact of FDI on sustainability remains unclear.

This study controls for the temporal effect by using time dummy variables that correspond to years for the 2012–2020 period. The sample period was selected in two steps. First, data availability from SolAbility for the dependent variable, GSCI was taken into consideration. Based on this first criterion, the sample period is between 2012 and 2021. However, data for control variables such as GDP and trade openness from the WDI dataset are available until 2020. In light of this second criterion, the final sample period is nine years, spanning the period from 2012 and 2020. The panel data are unbalanced with 252 country–year observations in this sample.

A panel of 38 countries in Asia was studied over a period of nine years from 2012 to 2020. The selection of countries was based on the availability of data. The countries in the sample are Armenia, Azerbaijan, Bangladesh, Cambodia, China, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Korea, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, and Yemen. Afghanistan, Bahrain, Bhutan, Brunei, Maldives, North Korea, State of Palestine, Syria, Taiwan, and Timor-Leste were excluded from the analysis due to incomplete data.

4 Results and discussion

4.1 Descriptive statistics

The descriptive statistics for the variables can be found in Table 3. Sustainability performance (*S*) in Asian countries is relatively low in general, with a mean value of 42.34 and a standard deviation of 5.15 (median = 45.40, *min* = 25, *max* = 56). As for its sub-components, Table 3 reports that governance (*G*) has a higher mean value of 48.94, with a range of 23.20 to 70.00. On the contrary, Asian countries have on average lower achievement in natural capital (*NC*) protection (mean = 38.47, *SD* = 10.26). Thus, in this comparison, the protection of natural capital in Asia is relatively weak.

With respect to the independent variable, Asia's *EPU* is 0.22 on average (median = 0.18), with a standard deviation of 0.19 during the sample period. There appears to be a gap ranging from a minimum of 0 to a maximum of 1.34 between 2012 and 2020. These differences imply a big disparity in the degree of EPU between countries during the years 2012–2020.

Table 3 Descriptive statistics of key variables

Variables	Mean	Median	Standard deviation (*SD*)	Minimum (*Min*)	Maximum (*Max*)
S	42.34	45.40	5.15	25	56
NC	38.47	36.8	10.26	13.6	72.80
SOC	44.84	45.4	6.89	22.1	60.00
G	48.94	50.00	7.82	23.20	70.00
EPU	0.22	0.18	0.19	0	1.34
GDP	714.00	1642.00	2040.00	5.57	14,600.00
TRADE	84.47	69.49	56.40	11.86	369.21
FDI	3.58	2.19	5.65	− 37.17	34.76

GDP is in billions USD

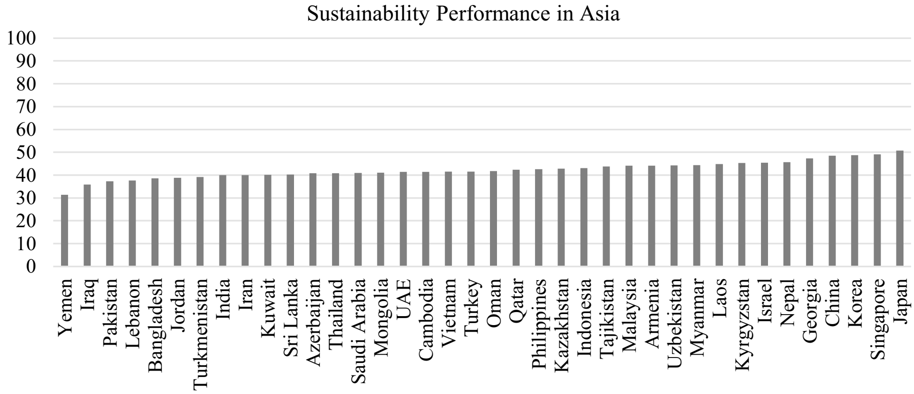

Fig. 1 Sustainability performance by countries

Table 4 Correlation and variance inflation factor (VIF)

	S	*NC*	*SOC*	*G*	*EPU*	*GDP*	*TRADE*	*FDI*
S	1.00							
NC	0.32***	1.00						
SOC	0.44***	−0.07	1.00					
G	0.32***	0.13**	0.33***	1.00				
EPU	−0.13**	0.027	−0.27***	−0.07	1.00			
GDP	0.15***	−0.23***	0.02	0.34***	−0.01	1.00		
TRADE	0.12**	−0.09	0.27***	−0.09**	−0.23***	−0.25***	1.00	
FDI	0.18***	0.01	0.11**	−0.15**	−0.13**	−0.21***	0.51***	1.00
VIF					1.06	1.07	1.46	1.37

*, **, ***indicate significance at the 10%, 5%, and 1%, respectively

Over the period, the average level of economic development (*GDP*) for the sample countries is 714, the lowest is 5.57, and the highest is 14,600. Turning to *TRADE*, it takes a value between 11.86 and 369.21 (mean = 84.47, *SD* = 56.40) while *FDI* has a mean score of 3.58 (*SD* = 5.65, *min* = −37.17, *max* = 34.76).

Figure 1 shows the average sustainability performance in Asia. Overall, country's sustainability performance has a score of less than 50 with the exception of Japan, 50.72. It seems that Yemen has the lowest achievement, 31.43. In short, there is a critical need for the Asian countries to improve their performance in terms of sustainable development in the near future.

4.2 Correlation and multicollinearity analyses

Table 4 shows the correlation matrices for the key variables for the years 2012–2020. As expected, sustainability performance, denoted as *S* and its sub-components, natural capital (*NC*), social capital (*SOC*), and governance (*G*) are positively correlated with $p < 0.01$.

EPU is negatively and significantly associated with *S* and *SOC*, at the level of 0.05 and 0.01, respectively. Though preliminary, these findings suggest that heightened EPU can lead to lower sustainability performance and social development. The correlation coefficient should, however, be interpreted with caution since it does not imply that the variables are causally linked.

Turning to the Pearson correlation coefficients of the control variables, *GDP* is significantly correlated with *S*, *NC*, and *G*, respectively, ranging between -0.23 and 0.34. The finding reveals that economic development is beneficial to sustainability development as a whole, but not the environment. *TRADE* and *FDI* are likewise positively related to *S*.

It can be seen from Table 4 that all correlation values are lower than 0.80, indicating that there is no issue of multicollinearity. Moreover, the Variance Inflation Factor (VIF) values, which are generally used to examine the models for multicollinearity problems, are less than 10, between 1.06 and 1.46. These findings are indicative of the absence of serious multicollinearity in the data (Hair et al., 2006).

4.3 Main regression results and discussions

The empirical analysis of this study is based on an unbalanced panel of 38 Asian countries over the 2012–2020 period. Table 5 reports the results of the regression estimation using sustainability performance (*S*) as the dependent variable. The estimated coefficient of *EPU* is -0.03 and is statistically significant at the 1% level (*z*-statistic = -2.78). This study exhibits congruence with previous studies on environmental sustainability that are currently accessible. For example, Zakari et al. (2021) reported that EPU has a positive relationship with CO_2 emissions in the 22 Organisation for Economic Cooperation and Development (OECD) countries for the years 1985–2017. There are other similar findings documented previously, including those by Xue et al. (2022) in France for the 1987–2019 period and Shabir et al. (2022) in 24 developed and developing nations between 2001 and 2019. Consistent with the hypothesis of this study, this result implies that countries with a higher EPU index have lower sustainability performance.

Table 5 EPU and sustainability performance

Variables	Coefficient	*z*-value	Standard error	Lower limit (95%)	Upper limit (95%)
Constant	2.89	6.91***	0.42	2.07	3.71
S_{t-1}	0.11	1.17	0.10	−0.08	0.29
EPU	−0.03	−2.78***	0.01	−0.05	-0.01
GDP	0.01	1.67*	0.01	−0.01	0.03
TRADE	0.03	1.16	0.03	−0.02	0.08
FDI	0.01	2.96***	0.01	0.00	0.01
Time effect	Yes				
Sargan test	24.85				
AR (2)	1.03				
# of countries	38				
# of observations	252				

*, **, ***Indicate significance at the 10%, 5%, and 1%, respectively. For simplicity of presentation, the time effects estimates were excluded from table

As already mentioned, in the event that governments shift their focus away from environmental degradation to other emergency concerns, for example, the EPU index may rise, resulting in negative effects on sustainable development. This implies that frequent policy adjustments may lead to ongoing uncertainty and disturbance, which could have serious repercussions for local economies. As a consequence, worries about EPU are likely to reduce a nation's motivation to engage in sustainability practices such as switching to renewable energy sources, decarbonisation, and reforestation.

Turning to other control variables, Table 5 shows that the signs of their coefficients largely correspond to those found in previous research. First, *GDP* is positively related to *S*, consistent with the ESG study by Ng et al. (2020). Second, *FDI* is positively related to sustainability performance in Asian nations (z-statistic = 2.96, $p < 0.01$). Likewise, Zhou and Xu (2022) supported that FDI is positively related to ecological development in China, and the finding of Shabir et al. (2022) demonstrates a comparable outcome using a panel of 24 nations.

In relation to the validity of using lagged variables as instruments, the Sargan test of over-identifying restrictions ($p > 0.05$) suggests that the instrumental variables are not correlated with the residuals in the GMM estimators. With regard to the second-order autocorrelation test, the statistic of *AR* (2) is insignificant ($p > 0.05$), and this result suggests that the errors exhibit no second-order serial correlation. As a whole, these findings show that the dynamic panel model used in this study is reasonable.

4.4 Robustness check: regression results of sub-components of sustainability

To address the knowledge gap concerning the different effects of EPU on sustainability performance by area, namely natural capital, social capital, and governance, the same regression model was employed using alternative proxies. This estimation is essential for policymakers to formulate a more focused and effective policy that will advance sustainability through ESG initiatives.

Table 6 shows the estimated results with natural capital (*NC*), social capital (*SOC*) and governance (*G*) as the dependent variables, respectively. As seen in the table, similar findings are reported when *NC* is defined as the dependent variable. The coefficient of *EPU* (β = -0.03, z-statistic = -2.04) is negative and significant at the level of 0.05. In line with the hypothesis, this finding implies that countries with a higher EPU index are associated with more environmental degradation issues. Other studies seem to echo the findings—Zhou et al. (2022) reported similar findings in the top five most polluted countries while it also happened in China, as stated by Amin and Dogan (2021). According to Wen and Zhang (2022), it appears that local governments in China have an economic incentive to reduce the level of environmental supervision when they experience increases in EPU, which in turn leads to industrial pollution. It is possible that an increase in EPU can lead to the consumption of cheaper and more traditional sources of energy which produce more pollutants. Taking this analogy to its logical conclusion, it would seem that economic actors would first have to revise their previous decisions in light of the regulatory intervention. Coupled with an increase in the cost of capital due to risk and uncertainty, EPU stifles firm investment ability in green technologies.

As shown in Column (2), the explanatory variable, EPU carries a negative and significant regression coefficient, at the 0.05 level. This result suggests that a rise in the EPU index will hinder social development. This finding is in line with a study by Wu and Zhao

Table 6 EPU and natural capital, social capital, and governance

Variables	(1) *NC*		(2) *SOC*		(3) *G*	
	Coefficient	*z*-value	Coefficient	*z*-value	Coefficient	*z*-value
Constant	2.29 (0.69)	3.29***	1.25 (0.35)	3.55***	1.50 (0.29)	5.28***
NC_{t-1}	0.32 (0.09)	3.74***				
SOC_{t-1}			0.60 (0.09)	6.36***		
G_{t-1}					0.17 (0.03)	6.64***
EPU	− 0.03 (0.02)	− 2.04**	− 0.01 (0.01)	− 2.10**	− 0.01 (0.01)	− 0.27
GDP	0.01 (0.01)	0.13	0.01 (0.01)	0.62	0.06 (0.01)	12.31***
TRADE	0.01 (0.06)	0.17	0.04 (0.03)	1.31	0.03 (0.02)	1.24
FDI	0.01 (0.01)	5.01***	0.01 (0.01)	0.13	− 0,01 (0.01)	−25.58***
Time effect	Yes		Yes		Yes	
Sargan test	22.28		23.07		30.17	
AR (2)	0.37		0.37		1.10	
# of countries	38		38		38	
# of observations	255		255		188	

*, **, ***Indicate significance at the 10%, 5%, and 1%, respectively. Standard errors are in the parentheses. For simplicity of presentation, the time effects estimates were excluded from table

(2022) which shows that household consumption is negatively associated with EPU, especially for spending on food and transportation. With respect to governance (*G*), Column (3) of Table 5 indicates that *EPU* exhibits a negative coefficient sign (*z*-statistic = -– 0.27) but it is insignificant.

This study depicts that EPU slows the social development progress in addition to being a factor in environmental quality. A sustainable society requires a significant amount of leadership and commitment from governments, which call for swift and effective actions on their part. When the EPU index increases, business and economic activities such as recruitment, investment, and other forms of expenditure may be delayed or reduced. As a result, job prospects diminish, which can have profound negative ramifications for social development, including access to quality education, electricity, and clean water.

Respectively, *GDP* and *TRADE* are reported to have a positive relationship with *NC* and *SOC* but the coefficients are not significant. A better economy is expected to lead to the development and adoption of sustainable technologies, and it is therefore quite surprising to see that *GDP* is not significantly affecting *NC* and *SOC,* individually. Meanwhile, *GDP* (β = 0.06, *z*-statistic = 12.31) is positive and significant in Column (3), indicating that economic development enhances governance efficiency. Similar to the results of sustainability performance reported earlier, *FDI* (β = 0.01, *z*-statistic = 5.01) has a positive and significant relationship with *NC*, but not *SOC*.

For the three regression results portrayed in Table 6, the results of the Sargan test and *AR* (2) satisfy the system GMM regression assumptions during modelling. As a whole, the statistical results throughout the entire sample period based on the dynamic GMM method are broadly in line with the postulation of this study.

5 Conclusions, implications and recommendations for future study

The issues of sustainable development have captured the attention of public. This matter, however, is not discussed in detail in the prevailing study. While some efforts have been made to understand the role of EPU in this connection, the primary focus of these attempts has been on the quality of the environment. To expand the growing literature on sustainability, as well as to contribute to the development of regulatory policies in this area, this study examines the impact of EPU on sustainability performance using a group of 38 Asian nations between 2012 and 2020. This study highlights that EPU is a cause for concern as it hinders the development of sustainability in the Asian regions. The results of the dynamic GMM regression model show that EPU is negatively related to sustainability performance in the national context, indicating that uncertainty around economic policy is detrimental to sustainability.

Additionally, this study provides a more comprehensive and deeper understanding of sustainability issues by examining the influence of EPU on its main sub-components: natural capital, social capital, and governance. Given the growing concern about sustainability challenges in the global community, it is timely and relevant to deliberate these topics, as well as providing a much-needed analysis of how EPU influences climate change, socio-economic vulnerability, and governance standards, which will help policymakers make informed decisions regarding these challenges. A similar finding is demonstrated by the GMM results for the sustainability sub-components—EPU has a negative effect on both social capital and natural capital protection, respectively. Thus, during periods of high EPU, environmental and social development are less likely to progress.

This study provides the following policy and managerial implications for promoting sustainability. To accomplish the SDGs, governments in Asia have a distinct responsibility and, as a result, they should be acutely aware of the substantial and specific impacts of EPU on sustainability. Ideally, the government should start by setting the agenda for long-term sustainability and then driving actions aligned with those objectives, such as reducing carbon emissions, adopting green technologies, and tackling food insecurity issues. Particularly, it is recommended that when designing and implementing roadmaps and policies, policymakers should incorporate sustainability principles and develop a rigorous governance process in order to guarantee the continuity of good regulations and enforcement procedures in the areas of economy, social, and ecological matters. The government should take all necessary measures to ensure that sustainability is placed at the forefront of its policies and activities. In this way, sound policies and activities related to sustainability, including decarbonisation efforts and the scaling up of cleaner energy solutions are likely to be effectively implemented both in the present as well as in future, regardless of any disruption that might occur during periods of EPU.

There is no doubt that green innovation and technologies are more capital intensive, so if the private sector is less inclined to incur the necessary expenses within the context of EPU, it could derail the efforts of Asian countries towards achieving an eco-friendly environment as well as undermine global social inclusion initiatives. Therefore, efforts should also be made to ensure that EPU itself does not further erode industries' motivation and confidence to invest in green technologies. Specifically, with the higher EPU level and the limited public funding available for sustainability initiatives in Asia, there is an urgent need for a much greater flow of investments from the private sector towards environmentally sound practices and technologies to achieve a more sustainable future in this region. There is a need for the government to create an enabling environment that is conducive to attracting investments that are in the public good and environmentally friendly. The use of green investment tax incentives, sustainable financing schemes, cash grants, and subsidies is just a few of the many tools that are becoming increasingly relevant.

In order to speed the shift to a sustainable economy, it could not be left solely up to regulators and policymakers. This study indicates that EPU is a constraint that corporations must be attentive to due to the increasingly volatile operating environment wrought by policy uncertainty. To mitigate the negative effects of higher EPU rates on corporate activities, corporate management must demonstrate strong leadership and a strong commitment to sustainability. This implies that, despite any uncertainty that may arise, it is crucial that corporations embed ESG considerations into their overall strategy, and more importantly remain dedicated to adapting and responding to environmental issues through changing their business plans and strategies, production patterns, and production-related technologies. They can also lead to socio-economic progress by cultivating ethical corporate cultures, adopting sustainable business models, and engaging with stakeholder actively even during periods of EPU.

There might be a case for slashing budgets in the interest of trying to reduce the budget deficit in uncertain economic times, which may eventually lead to less emphasis being placed on social and environmental goals. As a means of creating social cohesion and stability, it is imperative that non-governmental organisations, environmentalists, and social activists are able to observe, monitor, and criticise situations in which the administration has been deemed to be ineffective and inadequate in advancing sustainability, such as those related to climate change, human rights, and social inclusion.

This study demonstrates new evidence on the linkage between EPU and sustainability, but not without limitation. Some limitations in this study may open up potential research areas for the future. First, this study is restricted to a period of nine years due to a lack of data availability. The regression model may be re-examined with a larger panel to yield more generalisable findings in future. Second, since this study focused on the Asian regions, the results may differ in other regions due to varying levels of economic development. In future studies, it is recommended that the sample be expanded to other regions of the world, such as Europe and Africa, in order to make the results more general. Third, in this study, SolAbility's GSCI was used as an indicator of sustainability performance. Future studies may consider other relevant indicators so as to enhance the robustness of the findings. Fourth, this study used the system GMM estimation in analysing the relationship between EPU and sustainability. As a robustness check, future studies may consider other estimation methods, such as panel Granger causality and panel cointegration techniques. Last but not least, it is important to stress that having a consistent policy is vital to achieve sustainability in much greater degree but insufficient to ensure sustainability. If, however, a bad policy is consistently executed, it is natural to expect that this policy certainty will not be beneficial for a country. It is beyond the scope of this paper to discuss this issue; rather, this study reiterates the need for consistent economic policies that many scholars and practitioners have previously recognised.

Appendix

See Table 7.

Table 7 Average of key variables by countries (2012–2020)

Countries	*EPU*	*S*	*NC*	*SOC*	*G*	*GDP*	*TRADE*	*FDI*
Armenia	0.09	44.17	40.13	49.40	50.77	10,987,669,916.92	80.26	2.40
Azerbaijan	0.14	40.81	36.03	45.44	50.13	51,682,648,900.62	80.57	5.65
Bangladesh	0.27	38.62	34.29	42.24	51.46	213,417,603,370.19	39.98	1.05
Cambodia	0.22	41.41	51.04	37.74	45.63	19,362,712,557.44	125.79	12.72
China	0.24	48.49	33.80	48.08	60.23	11,869,139,519,934.00	40.21	2.00
Georgia	0.32	47.34	47.83	41.77	54.93	15,503,865,905.79	100.91	8.35
India	0.19	39.98	32.27	40.77	50.36	2,229,488,314,004.21	44.68	1.76
Indonesia	0.14	43.01	46.59	42.82	58.06	903,801,666,086.58	42.08	2.04
Iran	0.16	40.04	32.30	34.62	48.74	404,848,674,094.27	49.54	0.72
Iraq	0.43	35.82	30.03	34.01	40.24	174,824,043,315.22	66.04	− 2.25
Israel	0.12	45.43	30.13	45.66	54.93	313,729,375,441.31	60.31	4.20
Japan	0.12	50.72	42.61	56.08	58.94	4,449,561,236,663.97	33.95	0.50
Korea	0.40	48.78	34.67	50.37	55.66	1,504,593,775,255.29	83.09	0.70
Jordan	0.04	38.83	24.46	56.08	43.00	39,054,555,286.41	94.79	3.88
Kazakhstan	0.17	42.87	40.20	49.48	56.56	189,537,530,122.61	62.10	4.38
Kuwait	0.15	40.06	30.47	51.36	50.41	112,937,933,427.37	99.08	0.35
Kyrgyzstan	0.16	45.32	46.70	47.26	45.56	6,872,924,435.79	110.83	4.76
Laos	0.16	44.82	64.81	41.12	42.19	15,388,442,212.96	91.26	6.45
Lebanon	0.06	37.59	27.28	48.64	42.74	47,915,379,676.92	70.66	5.61
Malaysia	0.08	44.11	47.19	47.97	50.89	313,644,784,793.53	132.24	2.92
Mongolia	0.23	41.10	35.98	50.57	48.51	12,032,109,382.02	109.94	8.38
Myanmar	0.32	44.41	60.09	36.78	46.23	69,396,449,750.18	46.76	4.07
Nepal	0.31	45.64	46.92	46.69	47.74	25,737,143,419.75	44.17	0.37
Oman	0.28	41.72	35.08	49.78	52.56	79,004,508,539.73	93.54	2.66
Pakistan	0.29	37.33	34.14	39.42	46.09	284,457,744,164.48	29.19	0.69
Philippines	0.27	42.60	38.64	39.32	50.49	325,193,226,417.11	62.16	2.11
Qatar	0.26	42.31	33.27	51.86	52.70	158,611,025,666.71	94.87	− 0.27
Saudi Arabia	0.25	40.89	36.42	46.14	43.16	645,614,892,760.61	69.44	0.93
Singapore	0.13	49.11	27.82	52.19	39.27	315,939,409,368.64	334.96	23.87
Sri Lanka	0.26	40.19	38.98	41.86	44.47	82,635,785,046.82	49.61	1.17
Tajikistan	0.22	43.78	45.80	49.04	41.80	9,008,795,701.39	61.50	3.14
Thailand	0.08	40.87	35.62	39.23	49.60	415,819,305,563.49	121.76	1.74
Turkey	0.39	41.58	37.41	40.01	52.10	891,732,660,114.35	55.62	1.49
Turkmenistan	0.18	39.18	32.82	40.78	48.60	36,845,751,046.92	75.87	6.85
Uae	0.25	41.36	30.90	47.32	51.56	358,969,826,490.54	169.05	3.09
Uzbekistan	0.26	44.24	43.04	48.24	50.43	90,346,816,131.39	48.56	1.89
Vietnam	0.09	41.56	41.97	44.37	52.50	208,482,767,636.44	187.01	5.82
Yemen	0.80	31.43	33.51	27.60	27.57	46,937,412,533.00	43.16	− 0.72

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