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The Impact of Tourism Growth, Urbanization and Economic Growth on Greenhouse Gas Emissions of Bahrain

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ABSTRACT

The purpose of this study is to examine the impact that changes in tourism, urbanisation, and the economy have had on greenhouse gas emissions in Bahrain from 1995 to 2020. It will be the first of its kind to examine the relationship between external and endogenous elements from both a short-term and a long-term perspective. When second-order differentiation is present, the Johansen co-integration test detects short and long runs. With a speed of -0.079, the vector error correction model indicates a trend towards stability. Pairwise Granger causality testing reveals both unidirectional and bidirectional associations between variables. Tourist numbers only go up in response to an increase in carbon emissions. Growth in both tourism and the economy contributes to urban expansion in a unidirectional fashion. Urbanization and tourism both benefit from and contribute to one another's development. Politicians, economists, and academics in Bahrain may use the findings of this study to craft a policy that will last and is consistent with the Paris Agreement.

1. INTRODUCTION

Increased carbon emissions exacerbate climate change and endanger the global ecosphere. This is why regulators, policymakers, investors, businesses, and others with a vested interest in society pay attention to them. Chandio et al. [1] and Sarkodie et al. [2] both say that climate change is a significant factor in how the world's economies are doing. Economic changes primarily cause climate change, but its effects are felt on all continents. According to a 2017 report by the International Energy Agency, 70% of the world's energy-related carbon dioxide emissions are caused by urbanization. Also, 68% of all greenhouse gas emissions come from the energy sector, and fossil fuels and coal are responsible for 44%. In the absence of the pandemic, the Global Travel and Tourism Council predicts that international tourists will spend US$1.8 trillion in 2019; as a result, academics, researchers, and policymakers are paying attention to the debate over how tourism affects global GDP. In other words, they want to know if tourism contributes to economic growth. In 2019, tourism growth accounted for about 10.3% of global GDP (US$9.6 trillion) and produced 333 million jobs, or 10.3% of all jobs. The focus of development efforts is shifting from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs).

In the last 20 years, many studies have been done to determine what causes environmental pollution. As per Han et al. [3], economic activity and population growth are the main drivers of energy demand, which leads to pollution since most of the world's energy comes from fossil fuels like coal and oil. According to a report called "Energy (2019)," which came out not too long ago, energy-related carbon emissions have reached their highest point in history. Carbon emissions have proliferated because people use much energy, and the vast majority of that energy comes from fossil fuels. This has caused significant environmental problems worldwide [4].

Many environmental treaties and agreements have been made at the national, regional, and international levels to reduce carbon emissions and the damage they cause. For example, the 195 countries that signed the 2015 Paris Climate Agreement (COP21) agreed to implement policies and programs that would keep the rise in global temperature to less than 2 degrees Celsius, and Bahrain is among them. In order to comply with these pacts and agreements, businesses have had to make strides toward bettering the environment. Since then, several international conventions have called attention to this urgent environmental problem and urged the world's economies to fight climate change, in part by reducing carbon dioxide emissions [5].

Tourism is essential for every country because it helps the economy by bringing in money from other countries. This study about Bahrain's economy shows that more tourism will cause significant changes in how cities grow and how much economic growth, resulting in pollution and greenhouse gas emissions that harm the environment. This could happen because of new investments in tourism, more electricity and fossil fuel used by tourists, or the sectoral effects of tourism. It would be interesting to look into the role of tourism development in the energy sector, urbanization, and carbon dioxide emissions. The current study outline can incorporate the first part as the introduction, while Part 2 consists of existing literature that exposes the study's content. In contrast, the Part 3 methodology incorporates the various methods used to explore the study, and the Part 4 interpretation of the study's findings comes after that. Finally, Part 5 encompasses the entire work.

2. LITERATURE REVIEW

In the past decade, more research has been done on the economic factors affecting climate change and the climate-economy nexus. Since then, researchers have only looked at the growing concerns regarding the factors responsible for greenhouse gas emissions; among them, the travel industry is one of them. In connection with this, several researchers, like Liu et al. [6], Soylu [7], Wang [8], Simatupang [9], and Jaforullah [10], and who studied the tourism-growth nexus, found that tourism boosts economic growth. In connection with this, Lanza and Pigliaru [11] were some of the first to look at the relationship between tourism and growth from a theoretical point of view. According to their findings, countries with thriving tourism industries also have healthy economic growth. They developed a model called the Lucas type-two sector model, and according to that model, tourism is one industry that relies on the endowments of natural resources. Hence, countries rich in natural resources have a great deal of opportunity for expansion and the potential to make rapid progress.

Ozturk and Acaravci [12] use ARDL to predict the links between Turkey's economic growth, carbon dioxide emissions, energy use, and employment. Their results do not show any links between energy use, GDP, and the amount of carbon dioxide released into the atmosphere. In contrast, employment is generated in Turkey. The Granger causality relationships between energy use, economic growth, and carbon emissions were used by Jafri et al. [13]. From 1980 to 2007, Toda and Yamamoto's method was used to find the causalities among the variables. They found a unilateral causality from the urban population, economic growth, capital accumulation, and energy consumption to the environment. Also, they found strong evidence of a link between economic growth and the use of energy, emissions, and capital. Because of these ties, the government of Bahrain could work on long-term plans to save energy and cut carbon emissions without slowing down economic growth. Also, the long-term goal of high economic growth could reduce carbon emissions per unit of GDP if energy efficiency keeps improving.

Paramati et al. [14] say that international travel between 1995 and 2012 in both developing and developed economies caused the environment to get worse faster. Sharif et al. [15] examined the link between carbon dioxide emissions and Pakistan's tourism-driven economic growth from 1972 to 2013. The results of this study show that a country's carbon dioxide emissions are linked to how many tourists it gets. The environmental impact of tourism in that country has been demonstrated. Rayhan et al. [16] used the ARDL and EKC methods to examine how energy use and urbanization affected CO_2 emissions from 1973 to 2013. They found that urbanization and energy use have a statistically significant positive effect on carbon emissions but that economic openness and FDI do not. In 2020, Eyuboglu and Uzar examined the effects of tourism on the environment in Turkey from 1990 to 2014. They found that the number of foreign tourists and carbon dioxide emissions increased [17].

Quantile regression was the approach Sahni et al. [18] took in their research. The authors concluded that the expansion of tourism has a far more significant impact on the economy's expansion below the threshold than it does above. The second most important thing the study found was that countries with slower economic growth benefited the most from the rise in tourism. This was the second significant finding of the study. The study by Selvanathan et al. [19], which used ARDL, the vector error correction model (VECM), and panel frameworks, found that growth in tourism over a more extended period is good for the growth of the economy. Kyara et al. [20] established a one-way causal relationship between the growth of tourism and increased economic activity. These researchers came to similar conclusions as those presented above.

Nathaniel et al. [21] used the AMG estimator to look at the effects of trade, urbanization, and renewable energy on the ecological footprint in Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa (CIVETS) from 1990 to 2014. They found that non-renewable energy and urbanization worsen the environment, while trade and renewable energy improve it.

In the same way, Shakouri et al. [22] found that the number of international tourists in Asia and the Pacific increases carbon dioxide emissions. Koçak et al. [23] also found a positive correlation between international tourist arrivals and carbon dioxide emissions in their study of the world's most popular tourist destinations. In their study on Kuwait, Khan et al. [24] found that carbon dioxide emissions from energy, primary energy consumption, and economic growth led to a unidirectional causality towards tourism growth.

Abbasi et al. [25] examined what made Pakistan's economy grow from 1972 to 2018. They used the dynamic autoregressive distributed lag (ARDL) simulation method to look at positive and negative changes in energy consumption, industrial growth, urbanization, and carbon emissions related to Pakistan's economic growth. The frequency-domain causality (FDC) test checks long-, medium-, and short-run relationships. Our real-world data shows that electricity use and the value added by industries have short- and long-term effects on economic growth. However, carbon emissions and urbanization positively affect economic growth in the short run. So, they concluded that the use of energy, the growth of industry, the spread of cities, and the release of carbon dioxide all help Pakistan's economy grow. Khan [26] conducted a study to examine the interplay between oil consumption, urbanization, and economic growth in India's GHG emissions from 1965 to 2021. She uses a quantile regression analysis and finds that a 1% rise in greenhouse gas emissions is linked to a 0.34% rise in economic growth, a 0.599% rise in oil consumption, and a 0.28% drop in urbanization. Along with the quantile, she uses the Granger causality technique and finds that CO_2 emissions cause economic development and urbanization, but unidirectionally. On the other hand, oil consumption only has a one-way influence on carbon emissions and urbanization, and economic expansion only has a unidirectional effect on urbanization.

In the research done by Murshed et al. [27] between 2007 and 2018 in seven developing countries, it was found that improvements in energy efficiency, the use of renewable energy, financial inclusion, economic growth, globalization, and urbanization will all increase carbon productivity. Their expected net effects show that improvements in energy efficiency reduce the sizeable downward pressure on carbon productivity caused by financial inclusion, global trade, and urbanization. Khan et al. [28] looked at data from 1997 to 2018 to see what happened to the environment in the G7 and E7 countries when they used more renewable energy. They looked at the size of the economy and the number of people. By lowering load capacity factor levels, economic growth and population growth are bad for the environment. They also found evidence that economic growth and population size have a one-way effect on load capacity factor levels in the G7

and E7 countries.

Khan et al. [29] used panel ARDL to examine the relationship between carbon emissions and the number of tourists, economic growth, energy consumption, and oil consumption from 1995 to 2019. Their results show that tourism and environmental damage have significant and adverse effects. They also show that educated tourists follow the rules and laws about the environment in the countries they visit. As shown, a 1% increase in tourism improves the environment in the countries studied by about 0.21 percent. The potential of the next 11 nations to achieve their carbon dioxide emission reduction targets was investigated by Murshed et al. [30]. They looked at the ties between financial inclusion, the use of renewable energy, economic growth, international trade, and urbanization. Carbon dioxide emissions were reduced when these nations shifted to renewable energy sources. Increased carbon dioxide emissions resulted from increased economic expansion, expanded international commerce, and urbanization.

The literature study has shown how researchers have linked tourism to economic growth, urbanization, and greenhouse gas production. In the case of Bahrain's GHG output, our research will also be the first to compare and contrast both short-term and long-term plans for figuring out how endogenous and exogenous factors cause one another.

3. METHODOLOGY

3.1 Data

The World Development Indicators and the BP Statistics serve as data sources for this approach. BP provides data on energy-related CO_2 emissions, while World Development Indicators provides data on GDP growth (in current US dollars), tourism growth (in international tourist arrivals), and urbanisation (in percentage of urban population). Due to a lack of historical data in the database, the analysis only covers 1995-2020. It should adequately display the interrelationships between the variables throughout both the short and long term.

3.2 Model specification

Carbon emissions, economic growth, tourist arrivals in numbers and urbanization are just some of the study variables that are analysed using econometric models that have been used by other researchers before [30-33]. The model can be formulated as:

$$carbon\ emission = f(economic\ growth, tourism\ growth, urbanization) \quad (1)$$

Many studies have said that data series should be normalized before being used in an econometric model. A natural logarithmic transformation of all the variables in our study could help keep measurements the same across all variables, avoiding problems with distributional properties and possibly causing stationarity in the series of variables. This is especially true for carbon dioxide emissions from energy, tourist arrivals, economic growth, and urbanization, all measured in different indices and units. So, all of the variables are used in a real term and turned into a logarithmic function:

$$LY_t = log(Y_t) \quad (2)$$

This can also be characterized in a log-linear econometric format as:

$$lnc_t = \beta_o + \beta_1 lng_t + \beta_2 lnta_t + \beta_3 lnu_t + \varepsilon_t \quad (3)$$

where, β_0: constant term, β_1: coefficient of the variable (economic growth), β_2: coefficient of variables (number of tourist arrivals), β_3: coefficient of variables (urbanization), t: The time trend and εt: The random error term assumed to be normal, identically and independently distributed.

Long run Model can be expressed as:

$$lng_t = a_0 + a_1 lng_t + a_2 lnta_t + a_3 lnu_t + \varepsilon_t \quad (4)$$

Short run Model can be expressed as:

$$\Delta lnc_t = a + \sum_{i=1}^{k-1} \beta_i \Delta lnc_{t-i} + \sum_{j=1}^{k-1} \emptyset_j \Delta lng_{t-j} + \sum_{m=1}^{k-1} \theta_m \Delta lnta_{t-m} + \sum_{m=1}^{k-1} \omega_n \Delta lnu_{t-n} + \lambda_1 ECT_{t-1} + u_{1t} \quad (5)$$

where, *lnc*=Carbon dioxide emission from energy in log form, *lng*=Economic Growth measured in terms of GDP (current US$) in log form, *lnta*=Number of tourist arrivals in log form, *lnu*=Urbanization in log form, *k-1*=the optimal lag length is reduced by 1, $\beta_i, \emptyset_j, \theta_m, \omega_n$=short-run dynamic coefficients of the model's adjustment long-run equilibrium, λ_i=speed of adjustment parameter with a negative sign, ECT_{t-1}=the error correction term is the lagged value of the residuals obtained from the co-integration regression of the dependent variable on the regressors. Contains long-run information derived from the long-run co-integrating relationship, u_{it}=residuals in the equationsexample.

4. RESULTS AND DISCUSSIONS

Table 1 shows the descriptive statistics of the things examined in the study. The mean, median, maximum, and minimum values of carbon emissions from energy are 3.1, 3.11, 3.22, and 3.03, respectively, while the standard deviation value is 0.04; economic growth has a value of 9.76, 9.91, 10.16, and 9.13, respectively; tourist arrivals have values of 15.59, 15.76, 16.3, 14.46, and 0.59; and urbanization has values of 4.84, 4.48, 4.49, and 4.48, respectively.

Table 1. Descriptive Statistics

	LNC	LNG	LNTA	LNU
Mean	3.1	9.76	15.59	4.84
Median	3.11	9.91	15.76	4.48
Maximum	3.22	10.16	16.3	4.49
Minimum	3.03	9.13	14.46	4.48
Std. Dev.	0.04	0.38	0.59	0.004
Observation	26	26	26	26

Table 2 shows the correlation matrix, including the factors looked at in this study. Negative associations exist between carbon emissions from energy in a million metric tons and all endogenous variables. These interactions include a -0.15 for economic growth, a -0.49 for tourist arrivals, and a -0.03 for

urbanization. They show that, compared to the other factors in this study, the number of tourists has the most significant negative values.

Table 2. Correlation matrix

	LNC	LNG	LNTA	LNU
LNC	1			
LNG	-0.15	1		
LNTA	-0.49	0.8	1	
LNU	-0.03	0.73	0.42	1

Table 3 shows the results of the unit root test, which is a part of the Augmented-Dicky Fuller test and is used to figure out if the series is moving or not. At I (0) and I (1), the series for carbon emissions from energy stopped changing. This means the series for carbon emissions is the same at any level. Furthermore, the urbanization series became stationary at I (0) levels. On the other hand, the economic growth series stopped moving at I (1) levels, which means that economic growth stopped moving at the first order of difference. On the other hand, the number of tourist arrivals stopped changing at I (2) levels. This shows that the series has reached a point where it is stationary at the second order of difference.

After the unit root test, the author used the second-order lag to keep looking into the models. Table 4 depicts the Johansen co-integration test, which shows that at least one series has a co-integration, as indicated by the asterisk (*) mark. This shows that there are both long-term and short-term effects, which makes the vector error correction model (VECM) possible.

Table 3. Augmented Dicky Fuller unit root test

Variables	Levels	t-stats.	Prob.	Inference
	I(0)	-3.2	0.03	Series stationary at zero
LNC	I(1)	-3.6	0.01	Series stationary at first level
	I(0)	-1.46	0.54	Series became non-stationary at zero
LNG	I(1)	-4.5	0.001	Series stationary at first level
	I(0)	-1.64	0.45	Series became non-stationary at zero
	I(1)	-1.87	0.34	Series became non-stationary at first level
LNTA	I(2)	-4.57	0.002	Series stationary at Second difference
	I(0)	-3.29	0.03	Series stationary at zero
LNU	I(1)	-0.75	0.81	Series stationary at first level

Table 4. Johansen co-integration test for carbon emission as a dependent variable

S	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.*	Decision
None*	0.8	85.22	47.86	0	
At most 1*	0.74	46.1	29.8	0.0003	
At most 2	0.36	13.83	15.49	0.09	
At most 3	0.13	3.3	3.84	0.07	
S	Eigenvalue	Max-Eigen Statistics	0.05 Critical Value	Prob.*	
None*	0.8	39.12	27.58	0.001	Long Run VECM
At most 1*	0.74	32.27	21.13	0.0009	
At most 2	0.36	10.53	14.26	0.179	
At most 3	0.13	3.3	3.84	0.069	
LNC	LNG	LNTA	LNU		
1	-1.14	0.04	-79.2		
	-0.17	-0.08**	-17.84		

Note: **, represents the 10% significance level

The co-integration test result at the 0.10 level supports the short-run and long-run equations connecting carbon dioxide emissions from energy and tourist arrivals, while the probability values for the other variables are greater than 0.10. The following is a form of the normalized co-integrating coefficient that describes this phenomenon:

$$lnc = -1.14(lng) + 0.04(lnta) - 79.2(lnu) \quad (6)$$

Our ultimate objective is to track the long-term change in carbon dioxide emissions from energy (also known as LNC) as well as the other variables that are included in the model that is going to be researched. Because economic growth and urbanization are both statistically insignificant, their co-integration effect is invalid. On the other hand, tourist arrivals have a significant result of 10 percent, which reveals that an increase in the percentage of carbon emissions from energy will lead to a decrease in the number of tourist arrivals of 0.04 percent. Nevertheless, Johansen's co-integration test reveals the existence of co-integrated cells; hence, we will need to use the VEC model in order to carry out an extra test of our hypothesis. After a disturbance, the ECT provides an indication of the rate at which the model will make adjustments in order to return to equilibrium. The ECT coefficients can be expressed in terms of in a number of different ways.

$$ECT_{t-1} = \left[Y_{t-1} - \eta_j \chi_{t-1} - \xi_m R_{t-1}\right]$$
$$ECT_{t-1} = -0.079 lnc_{t-1} + 0.25 lng_{t-1} - 0.208 lnta_{t-1} - 0.0003 lnu_{t-1} \quad (7)$$

The negative and statistically significant ECT coefficients for carbon dioxide emissions from energy (LNC), tourist arrivals (LNTA), and urbanization (LNU) show that short-run dynamics converge to long-run equilibrium. In the event of a long-term disequilibrium, the corresponding adjustment coefficients were 0.079%, 0.208%, and 0.0003%. While for economic growth (LNG), the adjustment coefficient is small and positive. This means that there are no big changes to the path away from long-run equilibrium when the adjustment

coefficient is positive. The following notation can be used to express the short-run equation model:

$$\Delta lnc_t = -0.079\ ECT_{t-1} + 0.104 lnc_{t-1} - 0.04 lng_{t-1} - 0.009 lnta_{t-1} - 99.06 lnu_{t-1} + 0.05 \quad (8)$$

If the ECT is negative, economic growth (LNG), tourist arrivals (LNTA), urbanization (LNU), and carbon emissions from energy consumption (LNC) are all linked in the long run. If the coefficient has a negative sign, it can return to equilibrium. According to the short-run coefficient, more carbon emissions were made this year than before. It is anticipated that there will be a 0.104 percent increase in carbon emissions compared to the previous value of carbon emissions. A 1 percent increase in carbon emissions will be linked to a drop of 0.04% in economic growth. Every percentage point of carbon emissions from energy will lead to a decline in urban growth (LNU) of 99.06%. Similarly, a percentage increase in carbon emissions will lead to a decline in tourist arrivals of 0.009 percent.

Table 5 demonstrates pairwise Granger causality tests, which indicate that carbon emissions from energy have a one-way causation with the number of tourist arrivals. On the other hand, the number of tourist arrivals has the same one-way causation with the economic growth, while the economic growth has a unidirectional causation with the urban growth. Apart from these findings, the urban growth and number of tourist arrivals have a bi-directional causality.

Table 5. Pairwise granger causality tests

Observation	Parameters		F-Stats.	Prob.	Inference
	X	Y			
24	LNG	LNC	0.197	0.82	LNG≠LNC
	LNC	LNG	1.49	0.25	LNC≠LNG
24	LNTA	LNC	0.32	0.73	LNTA≠LNC
	LNC	LNTA	4.17	0.03	LNC→LNTA
24	LNU	LNC	1.1	0.35	LNU≠LNC
	LNC	LNU	0.06	0.94	LNC≠LNU
24	LNTA	LNG	2.82	0.09	LNTA→LNG
	LNG	LNTA	0.38	0.69	LNG≠LNTA
24	LNU	LNG	1.75	0.2	LNU≠LNG
	LNG	LNU	11.5	0.0005	LNG→LNU
24	LNU	LNTA	4.31	0.03	LNU→LNTA
	LNTA	LNU	7.19	0.005	LNTA→LNU

The CUSUM and CUSUM Square tests are depicted in Figures 1 and 2. Since the evaluated parameters fall between the two red lines in the figure, these tests show that they are statistically stable.

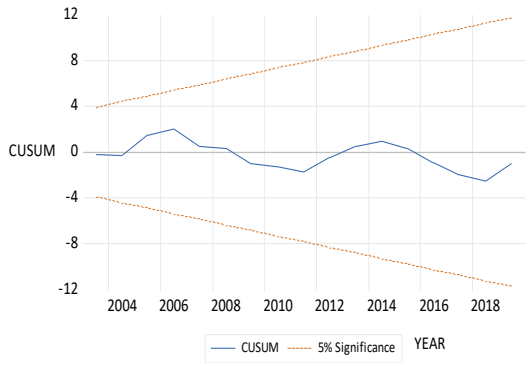

Figure 1. CUSUM

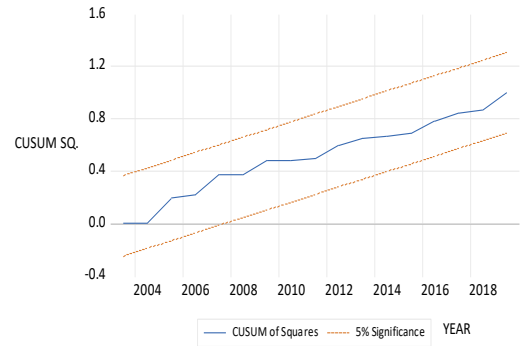

Figure 2. CUSUM Squares

5. CONCLUSIONS

Sustainable urban expansion (urbanization), sustainable economic growth, sustainable tourism, and lowering greenhouse gas emissions are some of the most challenging parts of fighting global warming, the most critical problem of our time. Recent years everywhere, and in Bahrain in particular, have been precarious. Since Bahrain is one of the driest countries in the world, this study will be the first to look at how tourism, urbanization, and growing economies affect carbon dioxide emissions in the region. In light of this, the goal of this research was to figure out effects of tourism growth, urbanization, and economic growth on the Bahrain's carbon emissions. In connection to this the foremost step is to convert the data into the natural log form and then it needs to be investigated with the Johansen co-integration test to identify the co-integration among the variables to be investigated.

The results of the Johansen co-integration test show that energy-related carbon emissions are negatively correlated with the number of tourists by 0.04. This is statistically significant at the 0.10 level. At the same time, the other variables are insignificant carbon emissions. The Johansen test indicates the presence of both short and long runs, paving the way for further investigation by the vector error correction model to identify the speed adjustment rate of -0.079. The long-run vector error correction model says a percentage increase in carbon emissions will slow economic growth by 1.14 percent. A percentage increase in carbon emissions would also slow urban growth by 79.2 percent. However, a percentage increase in carbon emissions will increase tourist arrivals by 0.04 percent; this might be due to an expansion in tourism development activities that cause the carbon emissions.

The pairwise Granger causality test shows one-way and

two-way causality between the examined variables. The carbon emissions from energy will have a one-way causality towards the number of tourist arrivals, while the number of tourist arrivals will have a unidirectional causality with economic growth, as supported by Kyara et al. [20], Selvanathan et al. [19], and Abbasi et al. [25]. On the other hand, economic growth will lead to urban growth, but uni-directionally. Both urbanization and the number of tourist arrivals have a bidirectional causality.

The current research, which only covers one nation, has to be expanded to include the other Gulf Cooperation Council members (GCC) members. Results from the current study cannot be extrapolated to the entire GCC area or even the rest of the world, for that matter. A panel can do similar research in the future, resulting in more reliable conclusions.

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