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Panel Data Evidence on the Relationship between Economic Growth, Electricity Consumption and CO_2 Emissions in the GCC.

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Abstract:

This paper intended to examine the impact of CO_2 and electricity consumption to growth the growth of Gulf Cooperation Council (GCC) economies. The period covered range from 1996 to 2013. This study formulates five panel data regression models. The empirical results indicate that capital accumulation and export are very important in terms of growth in the GCC economies. In addition, we found evidence that higher CO_2 and import decreases economic growth. At the same time, we find that, although electricity consumption contributes positively to the growth of GDP, but it is statically insignificant. Empirical findings suggest that: As long as the gross capital formation plays a key role in economic growth, thus they must encourage an increase in gross capital formation. In addition, since CO_2 contributes negatively to economic growth, policymakers should design and implement policies that enhance environmental friendly energy production and utilization.

Keywords: Economic growth, Electricity consumption, CO2 emissions, Panel data.

الملخص:

تهدف هذه الورقة إلى دراسة تأثير استهلاك ثاني أكسيد الكربون والكهرباء على نمو اقتصادات مجلس التعاون الخليجي. تتراوح الفترة المدروسة الفترة من 1996 إلى 2013. تم توصيف خمسة نماذج انحدار خاصة بالبيانات اللوحية(الدمج). تشير النتائج المقدرة إلى أن تراكم رأس المال والصادرات مهمان للغاية لعملية النمو في اقتصادات دول مجلس التعاون الخليجي. بالإضافة إلى ذلك ، وجدنا دليلًا على أن ارتفاع ثاني أكسيد الكربون والاستيرادات يساهمان سلبا في عملية النمو الاقتصادي. في الوقت نفسه ، نجد أنه على الرغم من أن استهلاك الكهرباء يساهم بشكل إيجابي في نمو الناتج المحلي الإجمالي ، إلا أنه غير معنوي احصائيا. تشير النتائج العملية إلى ما يلي: طالما أن تكوين رأس المال الإجمالي يلعب دورًا رئيسيًا في النمو الاقتصادي ، فيجب تشجيع زيادة تكوين رأس المال الإجمالي. بالإضافة إلى ذلك ، نظرًا لأن ثاني أكسيد الكربون يساهم بشكل سلبي في النمو الاقتصادي ، يجب على واضعي السياسات تصميم وتنفيذ سياسات تعزز إنتاج الطاقة الصديقة للبيئة واستخدامها.

The Scientific Journal of Cihan University – Slemani **PP: 33-47**
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پوختە:

مەبەست لەم چەند پەرەیە شیکردنەوەی کاری گەرنتی بەکارهێنانی دووەم ئۆکسیدی کاربۆن و کارەبا لەسەر گەشە ئابوریەکانی ئەنجومەنی هاریکاری

جەزیرەی عەرەبی یە لە سەردەمێکدا کە لەنێوان 1996 تا ساڵی 2013 دا گەیشتن بە خستنەبەردەستی پێنج نمونەی ڕووخاندن کە تایبەت بو بە ئەو زانیارییانەی کە لەسەر یەک نوسرابوو . ئەو ئەنجامانەی کە دانرابوون ئاماژەن بۆ کەڵەکەبوونی سەرمایەو ناردنی شت ومەک کە دوو هۆکاری گرنگن بۆ گەشەکردنی ئابووری وڵاتانی ئەنجومەنی هاریکاری عەرەبی لە جەزیرەی عەرەبی ، جگە لەوەش بەڵگەمان دەست کەوتوە کە بەرزبوونەوەی دووەم ئۆکسیدی کاربۆن هاوردەکردنی دەبنە دوو هۆکاری خراپ بۆ گەشەکردنی ئابووری لە هەمان کاتدا. لەگەڵ ئەوەشدا بەکارهێنانی کارەبا دەبێتە هۆکارێکی باش لە گەشەکردنی بەرهەمی ناوخۆ بە شێوەیەکی کەم بەڵام ئەوەندە هەیە ئاماری بۆ نەکراوە بۆیە ئەنجامە کردارییەکان ئاماژە بەوە دەکەن کە لەمەو دوا دێت لە کاتێکدایە هەموو سەرمایە کاریگەری باشی دەبێت و هۆکارێکی سەرەکیە لە گەشە کردنی ئابوری بۆیە پێویستە هاندان بکرێت بۆ بەرپاکردنی سەرمایە جگە لەوە دەبێت بزانین کە دووەم ئۆکسیدی کاربۆن کاریگەری خراپی دەبێت لە سەر گەشەکردنی ئابووری پێویستە لەسەر کەسانی سیاسەت مەدار سیاسەتەکان کاربکات لەسەر بەرهەم هێنانی وزە کە یارمەتی دەری ژینگە بێت و بەکاربهێنرێت.

Introduction

The central goal of an economy is to attain the sought after level of development and economic growth and to sustain at this level. Nations can't meet this goal without a number of difficulties. One of the most vital of these difficulties is the increases in (CO_2) emission and global warming and climate changes.

In the last few decades' number of studies has confirmed the nexus between energy consumption in general and electricity consumption in particular and economic growth. Some empirical results support the conservative hypothesis (Glasure, 2002; Ghali and El-Sakka, 2004; Akinlo, 2008; Apergis and Payne, 2009; Mohapatra and Giri 2015; Wang et.al, 2016). The gas emissions, from the different resources used in producing energy, increase the amount of carbon dioxide, which harms the green space as well as inflicting irreparable damages on the atmosphere. Thus CO_2 emissions must be reduced. Recognizing the importance of taking corrective measures to condense global warming several countries have signed the Kyoto Protocol and agreed to meet the target set under the Kyoto Protocol.

New data on CO_2 emissions indicate a high level and significant contribution to the GCC at the global level. Energy extraction, conversion sectors, particularly oil drilling, and electricity production are most reasons behind increasing CO_2 emissions. Especially if the generation of electricity is based on the combustion of fossil fuels. However, Some studies (e.g., Soytas et al., 2007; Soytas and Sari, 2009; Lean and Smyth, 2009) link this problem to the large increase in electricity consumption, and it is described by some as irrational.

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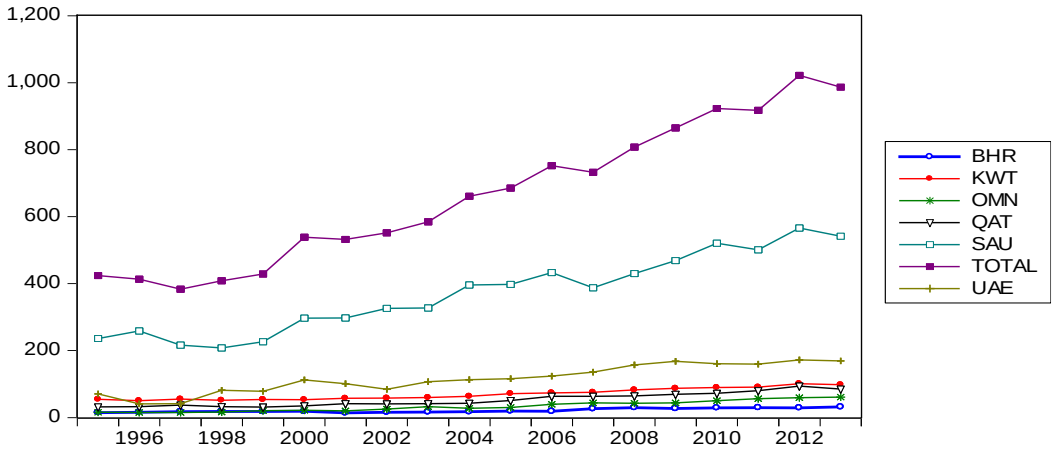

Figure1. CO2 total emissions (kt) for GCC

Figure 1 show that KSA lead the GCC countries in its CO2 emission contribution, followed by the UAE, Kuwait, Qatar, Oman, and Bahrain. All the countries show an increasing trend in their CO_2 emissions. (Qader, 2009).

This study analyzes the relationship between electricity consumption, CO2 emissions, and economic growth. Numerous studies have examined this issue (see for example, Grossman and Krueger 1991; Shafik 1994; Fatai, et al., 2004; Narayan and Smyth, 2005; Narayan and Singh 2007; Song et al. 2008; Soytas and Sari 2009; Chandran, Sharma, and Madhavan, K. 2010; Christopher and Douglason 2011; Borhan et al. 2012; Borhan, Ahmed and Hitam 2013; Shahbaz et al., 2014; Hamdi et al., 2014; Omri et al., 2015; Rashid et.al, 2017).
Although energy consumption in many studies is considered to be an important variable in achieving high rates of economic growth, to the extent that they have been adopted in many quantitative studies as one of the production factors, such as labor and capital. The problem of environmental pollution is not only a quality of Life mater, but beyond that it has negatively affected the overall productivity in the economy. The issue of environmental pollution has become a subject of great interest to researchers, policy makers, politicians and civil society at national and international levels. This interest is due to emission levels of climate changes.

This study attempts to address the relationship of CO_2, electricity consumption, labor, capital, exports and imports to the economic growth of the GCC countries over the period from 1996 to 2013. A panel data set for these countries will be used. Five models will be employed, namely: pooled ordinary least squares, and one way and two ways fixed effect models and one way and two random effect models. The importance of the study lies in the limited studies related to the Gulf countries, in addition to the its reliance on models not used in the previous studies.
The remainder of the study is structured as follows: Section 2 deals with the literature review. Section 3 econometric method and data. Section 4 presents the results and their interpretations. Section 5 reports Conclusion and Policy Recommendations.

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2. Literature Review

In the last few decades a large volume of empirical studies has examined the relationship between economic growth, CO_2 and energy or electricity consumption. Studies differ in the use of econometric methodologies, data types, region, time periods. The results reached by those studies according to the number of countries covered, can be

Table 1. Summary of previous empirical studies

Author(S)	Countries	Methodology	Period		Conclusions
Lee (2005)	8 developing countries	FMOLS	1975–2001		EC→ GDP
Richmond and Kaufman (2006)	36 nations	EKC hypothesis	1973–1997		No relationship
Masih and Masih (1996)	Malaysia, Singapore,and the Philippines	Error-correction model	1955–1990		Non-cointegrated
Azomahou et al. (2006)	100 countries	nonparametric panel approach	1960–1996		Linear relationship between GDP and CO2
Al Iriani (2006)	Gulf Cooperation Council	panel VAR	1971–2002		GDP → E
Chen et al. (2007)	10 developing countries in Asia.	panel-based error correction model	1971-2001		LR: GDP ↔ EC
Lee et al. (2008)	22 OECD countries	panel-based ECM	1960–2001		E→ GDP K → GDP
Lee and Chang (2008)	16 Asian countrie	panel-based ECM	1971–2002		LR EC→ GDP.
Apergis and Payne (2009)	6 central American countries	Panel-VECM	1971-2005		C ↔ Y ; E → C Y → C
Ciarreta, A., Aarraga , A., (2010)	12 European countries	VECM estimated by system GMM	1970-2007		E ↔ GDP and weak evidence between EC and EP.
Lean and Smyth (2010)	5 Asean countries	panel VECM	1980–2006		C → E
Arouri et al. (2012)	12 MENA countries	Panel unit root tests and cointegration	1981–2005		LR: E ↔ C
Govindaraju and Tang (2013)	China and India	VECM	1975-2001		SR: EC and CO_2 (India) LR: EC and CO_2 (China)
Stolyarova Elena (2013)	93 countries	Dynamic panel models	1960-2008		GDP →, CO2

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Omri Anis (2013)	14 MENA countries	Cobb-Douglas production function based on the panel data	1990-2011		E→ CO2
Salahuddin and Jeff (2014)	GCC	SUR, PMG	1980-2012		Positive association between E and CO2 ; and between GDP and E. GDP ≠ CO2
Rezitis and Shaikh Mostak (2015)	Nine South and Southeast Asian countries	PVA and Causality Analysis	1990-2012		Causality effects between energy consumption and economic growth
Behera and Dash (2017)	17 South East and South Asian countries (SSEA).	FMOLS DOLS	1980-2012		Cointegrating relationship existed among the studied variables

Notes: definitions of notation: →, ↔ and ≠ represent unidirectional, bi-directional causality and no causalitndy, respectively. Abbreviations defined as follows: SL and LR refer to short run and long run; CO_2, carbon emissions; L, labor; K, capital; ELC, electricity consumption; EC, electricity price; E, energy consumption; FDI, foreign direct investment; GDP, real or nominal GDP or GNP; EP, electricity price.Alternative methodologies ARDL bounds test (ARDL); Abbreviations for models: PVA, Panel Vector Autoregression Approach; VAR, vector autoregressive model; GMM, Generalized method of moment, FMOLS, full-modified OLS; DOLS, Dynamic OLS; EKC, Environment Kuznet's Curve; and VECM, vector error correction model.

categorized into two main strands: growth, CO_2 emission and economic growth for more than one country. For the purpose of this paper, we focus on studies that explore panel data properties. First strand based on the country level (e.g. Soytas and Sari, 2003; Oh and Lee, 2004; Altinay and Karagol, 2005; Lee and Chang, 2005; Yoo, 2005; Halicioglu, 2009; Ciarreta and Zarraga, 2009; Li et al., 2011; Shahbaz, 2013; Mohiuddin et al. 2016; Wang et al, 2016; Li et al, 2017).

The second strand provides empirical evidence on the relationship between economic of previous panel studies exploring relationships between energy or electricity consumption, CO2 and economic growth. Table 1 summarizes the previous empirical findings of the relationship between energy or electricity consumption, CO_2 and economic growth for a couple or a group of countries.

3. Econometric Method and Data

Panel data set can capture variations along both individual and cross section unit (country, region, state, consumer, individual, etc.). The combination of time series with cross-section can boost the quality and quantity of data in ways that would be not possible when using only one of these two dimensions (Gujarati, 2003).

In the study of panel data three frequently employed models, namely pooled ordinary least squares, fixed effects model and random effects model. In the present study, we estimated the first model in two estimation methods and use two versions of the other two models.

The Scientific Journal of Cihan University – Slemani **PP: 33-47**
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Consider an economic relationship that has a gross domestic product representing economic growth as a dependent variable, GDP, and five explanatory variables. The panel data consist of 6-countries and 18-time periods.

$$\mathrm{LnGDP_{it}} = \beta_0 + \beta_{1i}\mathrm{lnCO2_{it}} + \beta_{2i}\mathrm{lnFD_{it}} + \beta_{3i}\mathrm{lnOP_{it}} + \beta_{4i}\mathrm{lnELC_{it}} + \beta_{5i}\mathrm{lnK_{it}} + \varepsilon_{it} \dots\dots\dots\dots (1)$$

Where, GDP is the gross domestic product, CO2 is the CO2 emission per capita, FD is the financial development, OP is the trade openness, ELC is the electricity consumptions, and K is the capital stock. β_0 is the constant. ε_{it} is the error term for country i in the period t, satisfies all the standard assumptions? j_i are the estimated coefficients of all independent variables which j = 1, …, 5. The subscript I =1,6 denotes the six GCC countries. The subscript t = 1, …,18 denotes the time period, (1996-2013). Table 2 summarizes all variables used in this study.

Although on prior we expect that the GCC countries have too much similarities between them, but still there are some differences between them, at least in their country sizes, economics endowments, geographical locations, political and economic policies, etc. Heterogeneity among the studied countries could result in biasedness of the estimated parameters. Accordingly, it seems reasonable to account for the heterogeneity among the GCC countries.

Table 2. Variables definition

Variable	Indicator Name	Source
CO2	CO2 emissions (metric tons per capita)	WDI from The World Bank, http://www.worldbank.org/
EC	Energy Consumption (kg of oil equivalent per capita)	WDI from The World Bank, http://www.worldbank.org/
FD	Domestic credit to private sector (% of GDP)	WDI from The World Bank, http://www.worldbank.org/
GDP	GDP per capita (constant 2010 US$)	WDI from The World Bank http://www.worldbank.org/
K	Gross fixed capital formation (constant 2010 US$)	Penn World Table 9.0. provided by Feenstra et al., available for download at www.ggdc.net/pwt
T0P	Trade (% of GDP)	WDI from The World Bank http://www.worldbank.org/

Respecification of model (1) that can incorporate unobservable country effects would be as follows:

$$\mathrm{lnGDP_{it}} = \beta_0 + u_i + \beta_{1i}\mathrm{lnCO2_{it}} + \beta_{2i}\mathrm{lnFD_{it}} + \beta_{3i}\mathrm{lnOP_{it}} + \beta_{4i}\mathrm{lnELC_{it}} + \beta_{5i}\mathrm{lnK_{it}} + u_{it} \dots (2)$$

$$u_{it} = \mu_i + \varepsilon_{it}$$

Where, i being GCC countries unobservable effects.

At this time, μ_i is a random variable in the fixed effects model, and it is assumed that there is correlation with the explanatory variable. In other words,

$$\mathrm{Cov}(\mu_i, X_{it}) \neq 0$$

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The component i represent all unobserved factors that vary across countries, but are constant over time. The component ε_{it} represents all unobserved factors that vary across countries and time. Having multiple years of data for each country enables the inclusion of time country, thereby controlling for a range of time-invariant country characteristics, which may baise the estimated coefficients. Thus, the fixed effects model (3) can be extended to count for both individual as well as time effects variation this would be the two-way fixed effects model.

$$\ln GDP_{it} = \beta_0 + \beta_{1i}\ln CO2_{it} + \beta_{2i}\ln FD_{it} + \beta_{3i}\ln OP_{it} + \beta_{4i}\ln ELC_{it} + \beta_{5i}\ln K_{it} + u_{it} \dots\dots\dots (3)$$
$$u_{it} = \gamma_t + \mu_i + \varepsilon_{it}$$

However, μ_i is constant in the time series' direction, γ_t is constant in the cross section direction. Individual effects μ_i, and the time effect γ_t are each random variable, and the explanatory variable and the individual effect, the explanatory variable and the time effect are correlated (Greene, 2007).

For fixed effect model estimation, there are two ways which are within effect and between effect estimation. The estimators produce identical slope of non-dummy independent variables, but they produce different parameter estimates (Wooldridge, 2012).

As an alternative to the individual fixed effects model, we may consider a random effects formulation. The difference between the Fixed Effect Model and the random effect model is that the latter handles the constants for each section not as fixed, but as random parameters. The one way random effects model of equation (1) might be written as:

$$\ln GDP_{it} = \beta_0 + \beta_{1i}\ln CO2_{it} + \beta_{2i}\ln FD_{it} + \beta_{3i}\ln OP_{it} + \beta_{4i}\ln ELC_{it} + \beta_{5i}\ln K_{it} + u_{it} \dots\dots\dots (4)$$

$$u_{it} = \gamma_t + \mu_i + \varepsilon_{it}$$

The random effects model depends on both the cross-section and the time series within it, the error components models are referred to as a two-way random effects model. In that case, the error term should be uncorrelated with the time series component and the cross-sectional (group) error. The orthogonality of these components allows the general error to be decomposed into cross-sectional specific, temporal, and individual error components.

$$\text{Ln}GDP_{it} = \beta_0 + \beta_{1i}\ln CO2_{it} + \beta_{2i}\ln FD_{it} + \beta_{3i}\ln OP_{it} + \beta_{4i}\ln ELC_{it} + \beta_{5i}\ln K_{it} + u_{it} \dots\dots (5)$$

$$u_{it} = \gamma_t + \mu_i + \varepsilon_{it}$$

Random effect μ_i is assumed to be constant in the time dimension, tis constant in the cross section direction, and each is a random variable. Furthermore, it is assumed that explanatory variables and individual effects, explanatory variables and temporal effects are uncorrelated.

The Scientific Journal of Cihan University – Slemani **PP: 33-47**
Volume (4), Issue (1), December 2020
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4. Results of the analysis:

4.1 Panel Unit Root Tests Results

In table 3 the results of the LLC, IPS, Fisher-ADF, and Fisher-PP panel unit root tests. We have performed each test for the level and first difference of the variables employed in this study.

For the variables in level form, the null hypothesis of a unit root cannot be rejected for the IPS, Fisher-ADF, and Fisher-PP tests, except for export variable when LLC test is considered, at the 1% significance level for all variables. After taking the first difference of variables, the four tests rejected the null hypothesis at the 1% significance level.

Table 3: panel data unit root tests

Form	Variables	L.LC	IPS	ADF-Fisher	PP-Fisher	Conclusions
	LN GDP		Level			Non-Stationary
		0.01785	0.61535	6.79244	7.65575	
		(-0.5071)	(-0.7308)	(-0.871)	(-0.8114)	
	LN K	-0.90719	-0.93043	14.0144	10.4504	Non-Stationary
		(0.1822)	(0.1761)	(0.2998)	(0.5765)	
	LN ELC	-0.83222	0.00995	10.6173	12.0889	Non-Stationary
		(0.2026)	(0.504)	(0.562)	(0.4386)	
	LN EXP	-2.0471	-1.42408	17.7694	11.3142	Non-Stationary
		(0.0203)[b]	(0.0772)[c]	(0.1229)	(0.5022)	
	LN IMP	-1.02567	-0.27135	10.9832	9.46654	Non-Stationary
		(0.1525)	(0.3931)	(0.5304)	(0.6626)	
	LN CO2	-0.83222	0.00995	10.6173	12.0889	Non-Stationary
		(0.2026)	(0.504)	(0.562)	(0.4386)	
		First Differences				
	LN GDP	-8.32589	-6.87733	56.5489	59.4052	Stationary
		(0.0000)[a]	(0.0000) [a]	(0.0000) [a]	(0.0000) [a]	
	LN K	-3.97704	-4.373	39.1206	60.1272	Stationary
		(0.0000) [a]	(0.0000) [a]	(0.0000) [a]	(0.0000) [a]	
	LN ELC	-11.3735	-10.0412	80.4666	85.056	Stationary
		(0.0000)[a]	(0.0000)[a]	(0.0000)[a]	(0.0000)[a]	
	LN EXP	-6.28427	-5.61526	48.2082	71.5171	Stationary
		(0.0000)[a]	(0.0000)[a]	(0.0000)[a]	(0.0000)[a]	
	LN IMP	-5.5903	-5.68154	49.019	64.5795	Stationary
		(0.0000 [a]	(0.0000)[a]	(0.0000)[a]	(0.0000)[a]	
	LN CO2	-11.3735	-10.0412	80.4666	85.056	Stationary
		(0.0000 [a]	(0.0000)[a]	(0.0000)[a]	(0.0000)[a]	

Notes: the figures in brackets denote the probabilities. [a] Denotes 1% level of significance; [b] denotes 5% level of significance; and [c] denotes 10% significant level.

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The Scientific Journal of Cihan University – Slemani **PP: 33-47**
Volume (4), Issue (1), june 2020
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Therefore, we can conclude that all variables (in first differences) are non-stationary and integrated of order one or I (1). This implies that the series of variables may exhibit a valid long-run relationship.

4.2. Panel Cointegration Test Results

For the robustness check, this paper used Pedroni Residual Cointegration Test. Table 4 reports the results of the panel cointegration tests. Results indicate that most of test statistics based on both within dimension and group-based approach statistics demonstrate the rejection of null

Table 4: Panel co-integration tests (Dependent variable: Real GDP)

Estimates	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	0.209	0.417	-1.279	0.900
Panel rho-Statistic	1.371	0.915	1.390	0.918
Panel PP-Statistic	-3.019	0.001 [a]	-2.597	0.005 [a]
Panel ADF-Statistic	-2.985	0.001[a]	-2.589	0.005 [a]
Group Statistics				
Group rho-Statistic	2.247	0.988		
Group PP-Statistic	-3.125	0.001 [a]		
Group ADF-Statistic	-3.000	0.001 [a]		

Notes: [a] indicate that the test statistic is significant at the 1 % level.
hypothesis of no cointegration in the favor of alternative that economic growth and the independent variables included in this study are cointegrated in GCC countries.

4.3. Model Selection

Table 5 shows the RMSEs for the six estimated models. It is clear that POLS model is the worst with an RMSE much larger than those from the other five models. The next smallest RMSE was obtained from the LSDV and the within fixed effect. The FEM (two way) gives the lowest RMSE. Therefore, the two way fixed effect model has been selected to quantify the relationship between economic growth and the selected independent variables.

Table 5: Root Mean Squared Error for each of the six estimated models

Model	**RMSE**
POLS	0.121697
LSDV	0.072011
FEM (one way)	0.072011
FEM (two way)	0.069280
REM (one way)	0.121697
REM (two way)	0.104383

The Scientific Journal of Cihan University – Slemani **PP: 33-47**
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4.4. Estimation Results and Discussion

Estimated results of the panel regression models reported in table 6. As expected, we find that export has positive and significant impacts on economic growth in the GCC countries. This finding justified by the fact that hydrocarbon export still plays a significant role in the Gulf economies, Hvidt (2013). The result in line with Hamdan (2016) for 17 Arab countries and Altaee & Al-Jafari (2016) for KSA.

From Table 7, it is clear that capital input has the second highest positive effect on economic growth. The coefficient of capital implies that 1 per cent increase in investment leads to about 36 per cent increase in economic growth. This implies that capital is an important factor of production; therefore, it stimulates economic growth. The findings are in line with those of Abdouli & Hammami (2017) for 17 MENA countries, Wang et al. (2011) for China, Shahbaz et al. (2012) for Pakistan, and Omri & Kahouli (2013) for 13 MENA countries.

Results indicate a negative impact for import on economic growth. The coefficient value of -0.1447 proposes that the GCC could be adversely affected due to the inflow of imports.

Table 6: POLS, one & two way FEMs and one & two way REMs estimates for GCC.

Variables	POLS	LSDV	(One way) FEM	(Two way) FEM	(One way) REM	(Two way) REM
C	-0.1190 (0.7254)	1.9384 (0.0326)**	1.9384 (0.0044)***	3.5147 (0.0285)**	-0.1190 (0.6581)	-0.2410 (0.4738)
LN K	0.2953 (0.0000)***	0.3204 (0.0000)***	0.3204 (0.0000)***	0.3644 (0.0000)***	0.2953 (0.0000)***	0.3030 (0.0000)***
LN LEC	0.0684 (0.0505)*	0.1888 (0.0125)**	0.1888 (0.0125)**	0.0544 (0.6765)	0.0684 (0.0739)*	0.1090 (0.0189)**
LN EXP	0.9253 (0.0000)***	0.4635 (0.0000)***	0.4635 (0.0000)***	0.4590 (0.0000)***	0.9253 (0.0000)***	0.8693 (0.0000)***
LN IMP	-0.2451 (0.0000)***	-0.1797 (0.0002)***	-0.1797 (0.0002)***	-0.1447 (0.0149)**	-0.2451 (0.0000)***	-0.2597 (0.0000)***
CO_2	-0.0588 (0.0180)**	-0.0982 (0.0570)*	-0.0982 (0.0570)*	-0.0965 (0.1131)	-0.0588 (0.0010)***	-0.0300 (0.2082)
D2		0.5906 (0.0000)***				
D3		0.2243 (0.0047)***				
D4		0.4484 (0.0000)***				
D5		0.7928 (0.0000)***				
D6		0.8041 (0.0880)*				
Adjusted R^2	0.985926	0.994818	0.994818	0.994185	0.985926	0.974568

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Notes: Values in parenthesis are the estimated p-values. ***Coefficient significant at the 1% level, ** Coefficient
significant at the 10% level, and * Coefficient significant at the 5% level.

In any event, the rise in per capita income and the high level of consumption leads to allocate a large part of imports to the import of luxury goods, which does not make a positive contribution to the process of economic growth. This result confirms the result obtained by Altaee & Al-Jafari (2016) for KSA, and similar to that of Mushtaq (2014), for China, Indonesia, Japan, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand.

The obtained empirical results from this paper indicated that carbon dioxide (CO_2) emissions effect negatively economic growth while the energy consumption effect it positively. In fact, a 1% increase in energy consumption raises economic growth of about 5.4 %. However, the coefficient associated with electricity variable is not significant. At the same time, a 1% increase in CO_2 emissions reduces economic growth by about 10%.

5. Conclusion and Policy Recommendations

In this study we have analyzed the impact of electricity consumption, CO_2 emission, export, import, and capital on economic growth in the GCC countries, namely KSA, Bahrain, UAE, Kuwait, Qatar, and Oman, by employing long annual data from 1996 to 2013. To appropriately deal with static panel models, we employed ordinary least squares (OLS), two & one way fixed effects (FE) and two & one-way random effect (RE) models.

In terms of recommendations and suggestions we can say, based on estimation results the following:

Firstly, CO_2 emission has negative impact on economic growth. Therefore, to mitigate the climate change effect, there is a need for collaboration among GCC countries. Policymakers should implement policies that encourage environmental friendly energy production and utilization as well as green technologies.

Secondly, according to our finding, export is the most important driver to economic growth. This gives a support for export -led growth hypothesis in the GCC countries. Thus, a great attention must be directed towards diversifying the GCC economies.

Thirdly, capital proves to be another important contributor to economic growth of the GCC members. Accordingly, GCC countries must increase their gross capital formation.

Fourthly, since import plays negative role in the economic growth process of the GCC countries, they should decrease their imports or at least change their policies to achieve higher economic growth.

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