The Validity of the Export-Led Growth Hypothesis: Some Evidence from the GCC

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Abstract

This study investigates the validity of the export-led growth hypothesis (ELG) in five GCC countries, namely, Bahrain, Kuwait, Oman, Saudi Arabia and the United Arab Emirates. The study uses an augmented production function and annual time series data over the period 1975-2016. For the estimation of the models, the Johansen cointegration test is employed to test the existence of a long-run relationship between growth and exports. In addition, the multivariate Granger causality test in a vector autoregressive model framework and a modified version of the Wald test are applied to examine the direction of the short-run and long-run causality respectively. The empirical results provide evidence to support the validity of the ELG hypothesis in the short-run for the UAE, while the converse is true for Bahrain. In addition, a bi-directional causality exists between exports and growth in the case of Kuwait. In the long-run, the validity of the ELG is confirmed in the case of Bahrain, while economic growth causes exports in the case of Kuwait and Saudi Arabia.

Keywords: Exports, Economic Growth, GCC, Causality

1. Introduction

Several studies have confirmed the positive effect of export expansion on economic growth. Exports growth fosters technological innovation and improves productivity through increased foreign exchange earnings, investments and the expansion of capital goods imports[1]. However, a number of studies note that exports have a negative or negligible effect on economic growth[2], especially in countries where primary exports constitute a large share of total exports[3]. Inasmuch as the GCC countries namely, Bahrain, Kuwait, Oman, Saudi Arabia and the United Arab Emirates, are natural resource abundant countries, which have achieved significant economic growth, this paper investigates whether merchandise exports are the cause of their success.

During the period 1975-2016, the gross domestic product (GDP) of the above GCC countries increased significantly, with an average annual growth rate of 4.4% (World Development Indicators, World Bank)[4]. In particular, the UAE and Oman achieved the highest GDP growth, at 5.3%, while Saudi Arabia had the lowest, 2.6%, when the world average annual GDP growth rate was estimated to be about 3% (World Development Indicators, World Bank). During the same period, the average growth of merchandise exports averaged 6.3%, with Kuwait experiencing the higher rate of export expansion among sample countries (13.1%) and Saudi Arabia the lowest, 2.3% (Table 1).

Moreover, during the 1975-2016 period, the average share of merchandise exports in GDP reached 73.8% for Bahrain, 51.7% for Kuwait, 51.4% for Oman, while in Saudi Arabia and the UAE, merchandise exports reached 43% and 54.6% respectively. Table 2 reveals the importance of merchandise exports in the sample countries. As can be seen, the average share of merchandise exports in GDP declined for Bahrain, Kuwait and Saudi Arabia, while it increased for Oman and UAE. The UAE experienced the most significant increase, from 43.3% in 1975-1985 to 80.9 in 2006-2016, while Bahrain experienced a decrease, from 97.7% to 59.9% (Table 2).

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[1] See studies by Chenery and Strout (1966), Balassa (1978), Feder (1982), Al-Yousif (1997), Vohra (2001), and Kalaitzi and Chamberlain (2020a).

[2] See studies by Myrdal (1957), Meier (1970), Sachs and Warner (1995), Lee and Huang (2002), and Kim and Lin (2009).

[3] See studies by Herzer et al. (2006), Kalaitzi and Cleeve (2018), and Kalaitzi and Chamberlain (2020b).

[4] During the examined period, the economies of all countries, except Saudi Arabia, have also grown faster than those of the MENA region (3.2%) and of high income countries (2.6%). Nevertheless, GCC growth rates have fluctuated significantly between sub-periods, in concert with oil price fluctuations. For further details, see Table A1 in the Appendix.

Table 1: Real GDP and Merchandise Exports Growth (%), 1975-2016

	GDP growth (%)	Merchandise exports growth (%)
Bahrain	5.1	3.4
Kuwait	3.8	13.1
Oman	5.3	5.3
Saudi Arabia	2.6	2.3
UAE	5.3	7.5

Source: Authors' calculation based on World Development Indicators, World Bank
Note: For GDP growth and exports growth during sub-periods, see Tables A1 and A2.

Table 2: Importance of Merchandise Exports, 1975-2016

	Exports share of GDP				
	1975-1985	1986-1995	1996-2005	2006-2016	1975-2016
Bahrain	97.7	72.7	63.7	59.9	73.8
Kuwait	63.9	37.9	45.6	57.6	51.7
Oman	50.6	43.1	52.0	59.2	51.4
Saudi Arabia	51.4	31.7	39.6	47.9	43.0
UAE	43.3	41.4	51.3	80.9	54.6

Source: Authors' calculation based on World Development Indicators, World Bank.

Accordingly, this paper focuses on the short-run and long-run causal effects of merchandise exports on economic growth in these countries. In doing so, the study contributes to the discourse on designing future policies for enhancing and sustaining economic growth in the GCC region, and, also, serves as a useful starting point for future studies of the relationship between exports and growth in other resource abundant countries.

Empirical findings provide evidence to support the existence of short-run causality from merchandise exports to economic growth in the UAE, causality from economic growth to exports in Bahrain, bi-directional causality for Kuwait, and no causality between exports and economic growth for Oman and Saudi Arabia. As for long-run causality, the results provide evidence to support the ELG for Bahrain, the growth-led exports hypothesis (GLE) for Kuwait and Saudi Arabia, and no causality between exports and economic growth for Oman and the UAE.

The remaining sections of this paper are organized as follows: Section 2 reviews the literature on the relationship between exports and economic growth, while the chosen methodology, empirical models and data sources are described in Section 3. Section 4 reports and interprets the empirical results, while Section 5 presents the conclusions and policy implications of this research.

2. Literature Review

Empirical literature has shown that export expansion has a positive impact on economic growth, which is referred to as export-led growth (ELG). Export growth increases a country's foreign exchange earnings, allowing the expansion of imports, which are essential to fostering productivity. At the same time, increased investment through export earnings improves the existing technology, leading to further economic growth (Chenery and Strout, 1966; Balassa, 1978; Feder, 1982; Al-Yousif, 1997; Vohra, 2001; Kalaitzi and Chamberlain, 2020a).

However, a small number of studies have found that exports have a negative or negligible effect on economic growth, noting that this effect arises from the fact that in some countries primary exports constitute a large share of total exports (Myrdal, 1957; Meier, 1970; Sachs and Warner, 1995; Lee and Huang, 2002; Kim and Lin, 2009). Oil exports, for instance, tend to have a negative effect on economic growth, as this category of exports does not offer knowledge spillovers and is subject to excessive price fluctuations, creating uncertainty in the economy (Herzer et al. 2006; Sodeyfi and Katircioglu, 2016; Kalaitzi and Cleeve, 2018; Kalaitzi and Chamberlain, 2020b).

In addition to the investigation of the exports' effect on economic growth, several studies have examined the causality between exports and economic growth. Most of these studies find that causality flows from exports to economic growth (Awokuse, 2003; Yanikkaya, 2003; Shirazi and Manap, 2004; Siliverstovs and Herzer, 2006; Ferreira, 2009; Gbaiye et al., 2013; Ahmad et al., 2018), though some find that causality runs from growth to exports (GLE) or that there is a bi-directional causal relationship (ELG-GLE) between exports and economic growth (Panas and Vamvoukas, 2002; Narayan et al., 2007; Elbeydi et al., 2010; Kalaitzi and Cleeve, 2018; Mishra, 2011; Dinç and Gökmen, 2019). A few studies indicate no causal link between exports and economic growth (Kwan and Cotsomitis, 1991; El- Sakka and Al-Mutairi, 2000; Tang, 2006).

In the Middle East and North Africa (MENA) region, evidence on the direction of the causality between exports and economic growth is mixed. Previous studies in the region have used different theoretical models to examine the validity of the ELG hypothesis, with the majority of studies using bivariate or trivariate systems (El-Sakka and Al-Mutairi, 2000; Abu Al-Foul, 2004; Abu-Qarn and Abu-Bader, 2004; Elbeydi et al., 2010), while a small number use augmented production functions (Al-Yousif, 1997; Hosseini and Tan, 2014; Kalaitzi and Cleeve, 2018; Kalaitzi and Chamberlain, 2020a). It should be noted that mixed results may also be due to certain characteristics of the modelling exercise, such as the lag order selection, inclusion of deterministic trends and estimation period (Giles and Williams, 2000b).

In particular, two earlier time series studies by Al-Yousif (1997) and El-Sakka and Al-Mutairi (2000) support the existence of a long-run relationship between exports and growth, but their results about the short-run effect of exports on economic growth are mixed. Al-Yousif (1997) finds that exports positively affect economic growth in the short-run for all countries examined, namely Saudi Arabia, Kuwait, UAE and Oman, over the period 1973-1993. In contrast, El-Sakka and Al-Mutairi (2000)[5] find no short-run causality between exports and economic growth for Kuwait and Qatar, while a bi-directional causal relationship was found for Oman and Bahrain. In the case of the UAE, causality runs from growth to exports, while causality runs from exports to growth for Saudi Arabia. According to El-Sakka and Al-Mutairi (2000:164), "Arab oil-exporting countries got direct benefits out of the high oil prices and foreign exchange inflows".

Al-Yousif (1997) and El-Sakka and Al-Mutairi (2000) draw different conclusions for the relationship between exports and economic growth in the region and this may be due to the use of different methodologies. Al-Yousif (1997) uses an augmented production function and the two step cointegration technique to test for the existence of a long-run relationship between the variables, while the OLS method is used for the short-run effect of exports on growth. El-Sakka and Al-Mutairi (2000) use a bivariate framework, but more advanced econometric techniques, such as alternate versions of Granger's causality test.

[5] El-Sakka and Al-Mutairi (2000) also include in the sample, Libya, Tunisia, Sudan, Algeria, Egypt, Jordan, Mauritania, Iraq, Morocco and Syria.

In particular, Al-Yousif (1997) supports the ELG in the short-run based on a single equation model and on the statistical significance of the coefficients of the export variables. But the estimation of a single equation suffers from a misspecification problem, as the impact does not necessarily run from exports to economic growth, leading to inconsistent results. More advanced techniques, such as causality tests, can indicate whether exports cause economic growth or vice versa. However, the use of bivariate systems, as in the case of El-Sakka and Al-Mutairi (2000), may lead to biased and misleading results inasmuch as causality tests are sensitive to omitted variables.

Later studies using data for the region have also used bivariate or trivariate causality tests. The study by Abu Al-Foul (2004) analyses the relationship between exports and economic growth in Jordan over the period 1976-1997, using Hsiao's version of the Granger causality test in a bivariate framework. The study's findings indicate that there is a uni-directional causal relationship between exports and economic growth. These results confirm, in part, the results of El-Sakka and Al-Mutairi (2000)[6], but contradict those of Abu-Qarn and Abu-Bader (2004), which indicate no causality between the variables.

In particular, Abu-Qarn and Abu-Bader (2004) investigate the relationship between exports and economic growth for nine MENA countries. The study applies the Johansen cointegration test and the Granger causality test in a trivariate systems framework. The cointegration results using total exports show that there is a long-run relationship between the variables in the case of Jordan, Egypt, Morocco and Tunisia. In the short-run, Granger causality indicates that a uni-directional causality runs from exports to economic growth in the case of Iran, while in the case of Israel, Sudan and Turkey the causality runs from growth to exports. There is no causality between total exports and economic growth for Algeria, Egypt, Jordan, Morocco and Tunisia.

Elbeydi et al. (2010) examine the relationship between exports and economic growth for Libya over the period 1980-2007. Their study is based on the Johansen cointegration test and Granger causality test in a trivariate framework. The cointegration results show a long-run relationship exists between the variables, while a long-run bi-directional causality exists between exports and economic growth. It should be noted that the long-

[6] El-Sakka and Al-Mutairi (2000) provide evidence in support of the existence of a bi-directional causal relationship between exports and growth in the case of Jordan (1970-1997).

run causality is supported based on the significance of the lagged error correction coefficients. However, in a trivariate framework, only the joint causality from the independent variables to the dependent variable can be identified in the long-run.

Recent studies use augmented production functions and advanced multivariate techniques (Hosseini and Tang, 2014; Kalaitzi and Cleeve, 2018; Kalaitzi and Chamberlain, 2020a). Hosseini and Tang (2014) investigate the causal relationship between oil and non-oil exports in Iran, using the Granger causality test in a VECM framework. The study shows that oil and gas exports and non-oil exports Granger cause economic growth, indicating that the ELG hypothesis is valid in the short-run in the case of Iran, confirming the results of Abu-Qarn and Abu-Bader (2004).

Kalaitzi and Cleeve (2018) investigate the causality between primary exports, manufactured exports and economic growth in the UAE over the period 1981-2012, using an augmented production function. This study applies the Granger causality test in a VECM framework and a modified Wald test proposed by Toda and Yamamoto (1995). Their results provide evidence to support a bi-directional causality between manufactured exports and economic growth in the short-run and the GLE hypothesis in the long-run.

The most recent study, Kalaitzi and Chamberlain (2020a), investigates the validity of the ELG hypothesis in the UAE over the period 1975–2012, using a framework and methodology similar to that of Kalaitzi and Cleeve (2018). Their findings are in line with those of Al-Yousif (1997) regarding the validity of the ELG hypothesis in the short-run and in contrast with those of El-Sakka and Al-Mutairi (2000), which supported the GLE hypothesis. Although this study uses a similar methodology to that of Kalaitzi and Cleeve (2018), the results only partially agree, and this may be because of different proxies for the export variable. As for the long-run causality, their results do not provide evidence to support the ELG or the GLE hypothesis for the UAE.

The present study follows Kalaitzi and Chamberlain (2020a) and re-investigates the ELG hypothesis in the GCC countries, overcoming the methodological limitations of the earlier studies of the region.

3. Research Methodology

The present study examines the validity of the ELG hypothesis, assuming the aggregate production of an economy can be expressed as a function of physical capital, human capital, merchandise exports and imports of goods and services, following Kalaitzi and Chamberlain (2020a):

$$Y_t = A_t K_t^{\alpha} HC_t^{\beta}, \quad (1)$$

where Y_t denotes the aggregate production of the economy at time t, A_t is total factor productivity, while K_t and HC_t represent physical capital and human capital respectively. The constants α and β are, in turn, the output elasticities of physical and human capital. Total factor productivity is expressed as a function of merchandise exports, EX_t, imports of goods and services, IMP_t, and other exogenous factors, C_t:

$$A_t = f(EX_t, IMP_t, C_t) = EX_t^{\gamma} IMP_t^{\delta} C_t \quad (2)$$

Combining equations (1) and (2) yields the following:

$$Y_t = C_t K_t^{\alpha} HC_t^{\beta} EX_t^{\gamma} IMP_t^{\delta} \quad (3)$$

α, β, γ and δ represent the elasticities of production with respect to the inputs of production: K_t, HC_t, EX_t, and IMP_t. After taking the natural logs of both sides of equation (3), the following is obtained:

$$LY_t = c + \alpha LK_t + \beta LHC_t + \gamma LEX_t + \delta LIMP_t + \varepsilon_t, \quad (4)$$

where c is the intercept, the coefficients α, β, γ and δ are constant elasticities, and ε_t is the error term.

This study uses annual time series for Bahrain, Kuwait, Oman, Saudi Arabia and UAE over the period 1975-2016, obtained from the World Bank-World Development Indicators and IMF-International Financial Statistics[7]. Gross domestic product is used as a proxy for economic growth (Y_t), gross fixed capital formation as a proxy for physical capital (K_t), population (15-64) as a proxy for human capital (HC_t), while merchandise exports and imports of goods and services are used as proxies for exports

[7] All data series are taken from World Bank sources, expect for the following, which are taken from IMF sources: Bahrain: GDP, K and IMP (1975-1979); Kuwait: K (2010-2016), HC (1992-1994); Oman: K (1982-1990) and IMP (1989); UAE: IMP and K (1975-1998 and 2001-2016).

(EX_t) and imports (IMP_t) respectively. The variables are expressed in real terms, using the GDP deflator taken from the World Bank, and are expressed in logarithmic form.

In order to investigate the existence of a causal relationship between exports and economic growth in the UAE, this study applies the following tests: a) unit root tests, in order to ensure that all variables included in the model are stationary; b) a cointegration test to confirm the existence of a long-run relationship between exports and economic growth; c) the multivariate Granger causality test to find the direction of any short-run causality; and d) a modified Wald test in an augmented vector autoregressive model to investigate the existence of long-run causality between exports and economic growth.

3.1 Unit Root Test

Before applying the Granger causality test, it is important to ensure that the variables are stationary. To do this, the augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979) and the Phillips-Perron (PP) test (Phillips and Perron, 1988) are applied[8], following Dolado et al.'s (1990) process for the inclusion of deterministic components in a unit root test equation.

3.2 Cointegration Test

To perform the Granger causality test, it is also important to investigate if the variables are cointegrated (Granger, 1988). For this reason, after assessing the stationary properties of the variables, a cointegration test will be performed using the Johansen procedure (Johansen, 1988). This test will determine the number of cointegrating vectors based on an unrestricted vector autoregression VAR(p) and by using likelihood ratio (LR) trace and maximum eigenvalue test statistics (Johansen, 1988).

It is important to note that the inclusion of too few lags in the cointegration test could lead to rejection of the null hypothesis, while too many lags could decrease the power of the test (Verbeek, 2012). For this reason, the lag length for the system is determined by minimizing the Schwarz information criterion (SIC). In addition to the selection of

[8] The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (Kwiatkowski et al., 1992) unit root test is also applied in the case where the ADF and PP tests provide conflicting results.

the optimal lag length, the inclusion of deterministic trends should be considered when testing for cointegration. In order to determine the best model, Pantula's principle is used (Pantula, 1989) .

3.3 Short-run Causality Test

The vector autoregressive model (VAR), developed by Sims (1980), is used to investigate whether exports cause economic growth, by including the optimal lag length of each variable in each equation (Gujarati, 2003). Providing the variables are integrated of order one, the VAR model (LY_t, LK_t, LHC_t, LEX_t, $LIMP_t$) can be expressed as follows:

$$\Delta LY_t = \alpha_{10} + \sum_{j=1}^{p} \beta_{1j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{1j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{1j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{1j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{1j} \Delta LIMP_{t-j} + \varepsilon_{1t} \quad (5)$$

$$\Delta LK_t = \alpha_{20} + \sum_{j=1}^{p} \beta_{2j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{2j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{2j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{2j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{2j} \Delta LIMP_{t-j} + \varepsilon_{2t} \quad (6)$$

$$\Delta LHC_t = \alpha_{30} + \sum_{j=1}^{p} \beta_{3j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{3j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{3j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{3j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{3j} \Delta LIMP_{t-j} + \varepsilon_{3t} \quad (7)$$

$$\Delta LEX_t = \alpha_{40} + \sum_{j=1}^{p} \beta_{4j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{4j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{4j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{4j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{4j} \Delta LIMP_{t-j} + \varepsilon_{4t} \quad (8)$$

$$\Delta LIMP_t = \alpha_{50} + \sum_{j=1}^{p} \beta_{5j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{5j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{5j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{5j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{5j} \Delta LIMP_{t-j} + \varepsilon_{5t} \quad (9)$$

LY_t represents economic growth, while LK_t, LHC_t, LEX_t and $LIMP_t$ represent the independent variables of equation (4). Δ is the difference operator, while β_{ij}, γ_{ij}, δ_{ij}, ζ_{ij} and θ_{ij} are the regression coefficients. As noted above, before estimating the VAR model, the cointegration test will be performed in order to investigate the existence of a long run relationship between the variables. If the variables are cointegrated, the causality can be tested by estimating the following restricted VAR model (VECM):

$$\Delta LY_t = \sum_{j=1}^{p} \beta_{1j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{1j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{1j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{1j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{1j} \Delta LIMP_{t-j} - \lambda_y ECT_{t-1} + \varepsilon_{1t} \quad (10)$$

$$\Delta LK_t = \sum_{j=1}^{p} \beta_{2j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{2j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{2j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{2j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{2j} \Delta LIMP_{t-j} - \lambda_k ECT_{t-1} + \varepsilon_{2t} \quad (11)$$

$$\Delta LHC_t = \sum_{j=1}^{p} \beta_{3j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{3j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{3j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{3j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{3j} \Delta LIMP_{t-j} - \lambda_{hc} ECT_{t-1} + \varepsilon_{3t} \quad (12)$$

$$\Delta LEX_t = \sum_{j=1}^{p} \beta_{4j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{4j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{4j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{4j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{4j} \Delta LIMP_{t-j} - \lambda_{Ex} ECT_{t-1} + \varepsilon_{4t} \quad (13)$$

$$\Delta LIMP_t = \sum_{j=1}^{p} \beta_{5j} \Delta LY_{t-j} + \sum_{j=1}^{p} \gamma_{5j} \Delta LK_{t-j} + \sum_{j=1}^{p} \delta_{5j} \Delta LHC_{t-j} + \sum_{j=1}^{p} \zeta_{5j} \Delta LEX_{t-j} + \sum_{j=1}^{p} \theta_{5j} \Delta LIMP_{t-j} - \lambda_{imp} ECT_{t-1} + \varepsilon_{5t} \quad (14)$$

Δ is the difference operator, β_{ij}, γ_{ij}, δ_{ij}, ζ_{ij}, θ_{ij} and λ_{ij} are the regression coefficients and ECT_{t-1} is the error correction term derived from the cointegration equation.

To substantiate the results, diagnostic tests[9] are conducted in order to determine whether the VAR/VECM models and their estimated equations are well specified and stable. In addition, the parameter constancy of the estimated equations is assessed by applying the cumulative sum of recursive residuals (CUSUM) test, which detects systematic structural changes (Brown et al., 1975). In particular, the CUSUM test is based on the statistic:

$$W_t = \sum_{k+1}^{t} w_t / s \qquad t = k+1, \ldots .. T \quad (15)$$

s is the standard deviation of the recursive residuals (w_t), defined as $w_t = (y_t - x_t' b_{t-1}) / (1 + x'_t (X_{t-1}' X_{t-1})^{-1} x_t)^{1/2}$. The numerator $y_t - x'_t b_{t-1}$ is the forecast error, b_{t-1} is the estimated coefficient vector up to period $t-1$ and x_t' is the row vector of observations on the regressors in period t. X_{t-1} denotes the $(t-1) \times k$ matrix of the regressors from period 1 to period $t-1$. If the b vector changes, W_t will tend to diverge from the zero mean value line; if the b vector remains constant, $E(W_t)=0$. The test shows

[9] The diagnostic tests include the Jarque-Bera normality test (Jarque and Bera, 1980, 1987), the Breusch-Godfrey LM test (Johansen, 1995) for the existence of autocorrelation, the White heteroskedasticity test (White, 1980) and the AR roots stability test (Lütkepohl, 1991).

parameter instability if the CUSUM statistic lies outside the area between the two 5% significance lines, the distance between which increases with t.

After estimating the restricted or unrestricted VAR model, including all variables under consideration, a Granger causality test (Granger, 1969; Granger, 1988) will be conducted. The causality from exports to economic growth will be examined using a chi-square test, where the null hypothesis that exports do not Granger cause economic growth (H_0: $\sum_{j=1}^{p} \zeta_{1j} = 0$) is tested against the alternative hypothesis that exports Granger cause economic growth (H_A: $\sum_{j=1}^{p} \zeta_{1j} \neq 0$).

There are four possible results after testing for Granger causality: a) a uni-directional causal relationship from exports to economic growth, b) a bi-directional causal relationship[10] between exports and economic growth, c) a uni-directional causal relationship from economic growth to exports and d) no causal link between these variables.

3.4 Long-run Granger Causality Test

As mentioned above, the causality test based on VECM requires pretesting for the cointegrating rank. According to Clarke and Mirza (2006:207), "the practice of pretesting for cointegration can result in severe overrejections of the non-causal null", while type I and II errors may occur when testing for cointegration. In addition, as noted by Toda and Phillips (1993) the Granger causality tests in a VECM framework are complex and suffer from nuisance parameter dependency, asymptotically in some cases. In contrast, the Granger causality test proposed by Toda and Yamamoto (1995) performs well over a range of systems including stationary, near-stationary, and mixed integrated and stationary systems (Giles and Mirza, 1999; Giles and Williams, 2000a). In addition, the Toda and Yamamoto causality test does not require specification of the cointegrating rank (Giles and Williams, 2000b), avoiding pretesting biases. For this

[10] In the case of bi-directional causality between exports and economic growth, the wavelet method can be used to re-examine the direction of the causality in time and frequency domains, indicating which one is exact (Koltuniak, 2016 a-b; Aguiar-Conraria and Soares, 2011a–b; Ciesielska and Kołtuniak, 2017). According to Kołtuniak (2016a), traditional econometric methods, including Granger causality tests, "are not adequate to analyse data in terms of recurring structural changes, which may cause temporal reversals of causality directions between economic phenomena" (p.253). In the present study the CUSUM test is applied to detect systematic structural changes in the parameters. However, the wavelet analysis could check instability both in the time and frequency domains (Koltuniak, 2016b).

reason, this research applies the Toda and Yamamoto Granger causality test. Here the test involves the following model:

$$LY_t = \alpha_{10} + \sum_{j=1}^{p+dmax} \beta_{1j} LY_{t-j} + \sum_{j=1}^{p+dmax} \gamma_{1j} LK_{t-j} + \sum_{j=1}^{p+dmax} \delta_{1j} LHC_{t-j} + \sum_{j=1}^{p+dmax} \zeta_{1j} LEX_{t-j} + \sum_{j=1}^{p+dmax} \theta_{1j} LIMP_{t-j} + \varepsilon_{1t} \quad (16)$$

$$LK_t = \alpha_{20} + \sum_{j=1}^{p+dmax} \beta_{2j} LY_{t-j} + \sum_{j=1}^{p+dmax} \gamma_{2j} LK_{t-j} + \sum_{j=1}^{p+dmax} \delta_{2j} LHC_{t-j} + \sum_{j=1}^{p+dmax} \zeta_{2j} LEX_{t-j} + \sum_{j=1}^{p+dmax} \theta_{2j} LIMP_{t-j} + \varepsilon_{2t} \quad (17)$$

$$LHC_t = \alpha_{30} + \sum_{j=1}^{p+dmax} \beta_{3j} LY_{t-j} + \sum_{j=1}^{p+dmax} \gamma_{3j} LK_{t-j} + \sum_{j=1}^{p+dmax} \delta_{3j} LHC_{t-j} + \sum_{j=1}^{p+dmax} \zeta_{3j} LEX_{t-j} + \sum_{j=1}^{p+dmax} \theta_{3j} LIMP_{t-j} + \varepsilon_{3t} \quad (18)$$

$$LEX_t = \alpha_{40} + \sum_{j=1}^{p+dmax} \beta_{4j} LY_{t-j} + \sum_{j=1}^{p+dmax} \gamma_{4j} LK_{t-j} + \sum_{j=1}^{p+dmax} \delta_{4j} LHC_{t-j} + \sum_{j=1}^{p+dmax} \zeta_{4j} LEX_{t-j} + \sum_{j=1}^{p+dmax} \theta_{4j} LIMP_{t-j} + \varepsilon_{4t} \quad (19)$$

$$LIMP_t = \alpha_{50} + \sum_{j=1}^{p+dmax} \beta_{5j} LY_{t-j} + \sum_{j=1}^{p+dmax} \gamma_{5j} LK_{t-j} + \sum_{j=1}^{p+dmax} \delta_{5j} LHC_{t-j} + \sum_{j=1}^{p+dmax} \zeta_{5j} LEX_{t-j} + \sum_{j=1}^{p+dmax} \theta_{5j} LIMP_{t-j} + \varepsilon_{5t} \quad (20)$$

p is the optimal lag length, selected by minimising the value of the Schwartz information criterion (SIC), while $dmax$ is the maximum order of integration of the variables in the model. The selected lag length (p) is augmented by the maximum order of integration ($dmax$) and the chi-square test is applied to the first p VAR coefficients.

4. Empirical Results

4.1 Unit Root Test

Tables 3 and 4 present the results of the ADF and PP tests for the logarithmic level and first difference of the time series. The findings for both the ADF and PP test indicate that LY_t, LK_t, LHC_t, LEX_t and $LIMP_t$ are non-stationary at conventional levels of significance, while the first difference of LY_t, LK_t, LEX_t and $LIMP_t$ are stationary at 1% level for all countries. In the case of ΔLHC_t, the ADF test results show that the variable is stationary at the 1% level for Bahrain and UAE, at 10% for Kuwait and Oman, while it is found to be non-stationary for Saudi Arabia. In contrast, the PP test provides evidence that ΔLHC_t is stationary at 10% and 5% for Kuwait and UAE respectively, while it is found to be non-stationary for Bahrain, Oman and Saudi Arabia. As the ADF and PP tests provide conflicting results for the human capital variable, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root test is also applied and the results are presented in Table 5. The KPSS tests confirms that ΔLHC_t is stationary for all countries under examination, indicating that all the variables are integrated of order one.

Table 3: ADF test results, 1975-2016

	Bahrain	Kuwait	Oman	Saudi Arabia	UAE
LY_t	-2.73$^{(a)}$ [1]	-2.31$^{(a)}$ [0]	-2.06$^{(b)}$ [0]	-2.87$^{(a)}$ [2]	-3.11(a) [1]
ΔLY_t	-5.92$^{(b)}$ [0]***	-5.76$^{(c)}$ [0]***	-4.39$^{(b)}$ [1]***	-3.07$^{(c)}$ [1]***	-4.71(b) [0]***
LK_t	1.53$^{(c)}$ [0]	-1.84$^{(a)}$ [0]	-2.23$^{(a)}$ [0]	-1.70$^{(a)}$ [0]	2.58(c) [0]
ΔLK_t	-4.09$^{(c)}$ [1]***	-5.11$^{(c)}$ [0]***	-5.49$^{(c)}$ [0]***	-6.96$^{(a)}$ [0]***	-6.07(b) [0]***
LHC_t	-1.66$^{(a)}$ [2]	-2.16$^{(a)}$ [3]	-2.43$^{(a)}$ [2]	-1.477$^{(b)}$[1]	-2.44(a) [2]
ΔLHC_t	-3.62$^{(b)}$ [1]***	-1.70$^{(c)}$ [2]*	-2.71$^{(b)}$ [1]*	-1.25$^{(c)}$ [0]	-3.72(b) [1]***
LEX_t	-2.53$^{(a)}$ [0]	-2.19$^{(b)}$ [0]	1.86$^{(c)}$ [0]	0.08$^{(c)}$ [0]	-2.07(a) [0]
ΔLEX_t	-5.56$^{(c)}$ [0]***	-6.48$^{(c)}$ [1]***	-5.25$^{(c)}$ [0]***	-4.31$^{(c)}$ [0]***	-5.35(b) [0]***
$LIMP_t$	1.83$^{(c)}$ [0]	-3.12$^{(c)}$ [0]	1.62$^{(c)}$ [0]	1.37$^{(c)}$ [0]	-3.19(a) [1]
$\Delta LIMP_t$	-5.29$^{(c)}$ [0]***	-6.78$^{(c)}$ [0]***	-6.74$^{(c)}$ [0]***	-5.06$^{(c)}$ [0]***	-6.22(a) [8]***

Notes: *, **, *** denote the rejection of the null hypothesis of a unit root at 10%, 5% and 1% respectively. Numbers in [ ] are the optimal lags, chosen based on the Schwarz information criterion (SIC). The maximum lag length is found by rounding up $P_{max} = [12* (T/100)^{¼}] = [12* (42/100)^{¼}] \cong 10$ (Schwert, 1989). All the time series are tested for the unit root using intercept and trend (a), intercept only (b), and no constant or trend (c). The letters in brackets indicate the selected model following Dolado et al. (1990). Ho: a unit root exists, while Ha: the time series is stationary.

Table 4: PP test results, 1975-2016

	Bahrain	Kuwait	Oman	Saudi Arabia	UAE
LY_t	-3.50$^{(a)}$ {4}*	-2.27$^{(a)}$ {3}	-2.15$^{(b)}$ {5}	1.44$^{(c)}$ {2}	-3.03$^{(a)}$ {3}
ΔLY_t	-5.92$^{(b)}$ {0}***	-5.82$^{(c)}${5}***	-5.04$^{(b)}$ {4}***	-4.83$^{(c)}$ {0}***	-4.68$^{(b)}$ {1}***
LK_t	1.41$^{(c)}$ {3}	-1.64$^{(a)}$ {7}	-2.32$^{(a)}$ {2}	-1.70$^{(a)}$ {0}	2.54$^{(c)}$ {1}
ΔLK_t	-5.88$^{(c)}$ {2}***	-5.03$^{(c)}$ {16}***	-5.49$^{(c)}$ {0}***	-6.97$^{(a)}$ {1}***	-6.07$^{(b)}$ {2}***
LHC_t	6.58$^{(c)}$ {4}	3.98$^{(c)}$ {4}	8.39$^{(c)}$ {5}	-2.34$^{(a)}$ {5}	-1.10$^{(b)}$ {4}
ΔLHC_t	-1.41$^{(c)}$ {3}	-1.67$^{(c)}$ {3}*	-0.74$^{(c)}$ {3}	-1.09$^{(c)}$ {3}	-1.97$^{(c)}$ {4}**
LEX_t	-2.72$^{(a)}$ {1}	-2.86$^{(a)}$ {1}	1.81$^{(b)}$ {6}	0.06$^{(c)}$ {1}	-2.16$^{(a)}$ {4}
ΔLEX_t	-5.57$^{(c)}$ {1}***	-8.32$^{(c)}$ [11]***	-5.25$^{(c)}$ {0}***	-4.25$^{(c)}$ {3}***	-4.80$^{(c)}$ {5}***
$LIMP_t$	-2.27$^{(a)}$ {1}	-3.12$^{(c)}$ {0}	2.05$^{(c)}$ {3}	-1.91$^{(b)}$ {2}	-2.73$^{(a)}$ {3}
$\Delta LIMP_t$	-5.30$^{(c)}$ {1}***	-6.86$^{(c)}$ {5}***	-6.76$^{(c)}$ {2}***	-4.96$^{(c)}$ {4}***	-4.28$^{(b)}$ {2}***

Notes: *, **, *** denote the rejection of the null hypothesis of a unit root at 10%, 5% and 1% respectively. Bandwidth in { } (Newey-West automatic) uses the Bartlett kernel estimation method. All the time series are tested for the unit root including intercept and trend (a), intercept only (b), and no constant or trend (c). The letters in brackets indicate the selected model following Dolado et al. (1990). Ho: a unit root exists, while Ha: the time series is stationary.

Table 5: KPSS test results, 1975-2016

	Bahrain	Kuwait	Oman	Saudi Arabia	UAE
LHC_t	0.14$^{(a)}$ {5}***	0.77$^{(b)}$ {5}***	0.81$^{(b)}$ {5}***	0.15$^{(a)}$ {5}**	0.80$^{(b)}$ {5}***
ΔLHC_t	0.09$^{(b)}$ {4}	0.14$^{(b)}${4}	0.15$^{(b)}$ {5}	0.13$^{(a)}$ {5}	-0.11$^{(b)}$ {4}

Notes: *, **, *** denote the rejection of the null hypothesis at 10%, 5% and 1% respectively.
Bandwidth in{ } (Newey-West automatic) using the Bartlett kernel estimation method. All the time series are tested for the unit root including intercept and trend (a) and intercept only (b). The letters in brackets indicate the selected model following Dodado et al. (1990). Ho: the time series is stationary, while Ha: a unit root exists.

4.2 Cointegration Test

Since all variables are I(1), the Johansen cointegration test can be conducted in order to investigate the existence of a long-run relationship between the variables. The results are reported in Table 6.

Table 6: Johansen cointegration test results

Country	**Null Hypothesis**	**Trace Statistics**	**Max Eigenvalue**
Bahrain	r=0	91.33***	44.07***
	r≤1	47.27	19.33
Kuwait	r=0	136.29***	85.63***
	r≤1	50.66	20.90
Oman	r=0	64.62	28.51
	r≤1	36.10	18.74
Saudi Arabia	r=0	110.85***	51.58***
	r≤1	59.27***	31.52**
UAE	r=0	118.24***	55.52***
	r≤1	62.71***	29.55**

Notes: Critical values are taken from Osterwald-Lenum (1992).
The models for Bahrain, Kuwait, Oman and UAE include a restricted constant, while the model for Saudi Arabia includes a linear deterministic trend and a step dummy variable for the year 1985 as an exogenous variable (model selection following Pantula, 1989). The lag length for the cointegration test is determined by minimizing the Schwarz information criterion (SIC), while the diagnostic tests reveal that the residuals are multivariate normal, homoscedastic, with no evidence of serial correlation. *, ** and *** indicate rejection at 10%, 5% and 1% respectively.

The trace statistics indicate that the null hypothesis of no cointegration is rejected at the 1% significance level for all countries expect Oman, while the null hypothesis of one cointegrating equation is rejected in the case of Saudi Arabia and the UAE, indicating that two cointegrating vectors exist among the variables.

4.3 Short-run Granger Causality Test Results

Since the variables are I(1) and cointegrated in the case of Bahrain, Kuwait, Saudi Arabia and the UAE, VECMs should be specified, while a VAR model in first differences should be specified in the case of Oman, as the variables are found to be not cointegrated. The following tables present the Granger causality test results in a VECM framework for Bahrain, Kuwait, Saudi Arabia and the UAE, and in a VAR framework for Oman (Table 7-11).

Table 7: Short-run Granger causality test, Bahrain

	Source of Causality					
	ΔLY ΔLY_t	ΔLK_t	ΔLHC_t	ΔLEX_t	$\Delta LIMP_t$	***ALL***
Dependent Variable	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (4)
ΔLY_t	-	0.21	11.50***	0.14	1.14	12.30**
ΔLK_t	0.11	-	2.50	1.97	1.09	4.62
ΔLHC_t	0.53	2.89*	-	1.39	0.90	3.76
ΔLEX_t	3.42*	0.27	1.11	-	0.68	3.70
$\Delta LIMP_t$	0.97	0.002	2.05	0.30	-	2.44

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively (df in parentheses). The lag length for the VECM is determined by minimizing the Schwarz information criterion (SIC). The diagnostic tests for the VECM model show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG χ^2(25)= 0.11, BG χ^2(25)= 0.30, JB (10)= 0.29, W-het χ^2{180}= 0.94). In addition, the stability of the VECM is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 8: Short-run Granger causality test, Kuwait

	Source of Causality					
	ΔLY_t	ΔLK_t	ΔLHC_t	ΔLEX_t	$\Delta LIMP_t$	***ALL***
Dependent Variable	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (8)
ΔLY_t	-	8.38**	1.42	4.66*	10.23***	26.35***
ΔLK_t	1.76	-	2.88	0.45	0.19	8.57
ΔLHC_t	3.22	3.01	-	7.38**	5.57*	29.09***
ΔLEX_t	6.79**	9.11**	1.33	-	8.63**	27.52***
$\Delta LIMP_t$	2.07	0.58	1.11	1.49	-	5.30

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively (df in parentheses). The lag length for the VECM is determined by minimizing the Schwarz information criterion (SIC). The diagnostic tests for the VECM model show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG χ^2(25)= 0.60, BG χ2(25)= 0.55, JB (10)= 0.26, W-het χ2{330}= 0.58). In addition, the stability of the VECM is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 9: Short-run Granger causality test, Oman

	Source of Causality					
	ΔLY_t	ΔLK_t	ΔLHC_t	ΔLEX_t	$\Delta LIMP_t$	***ALL***
Dependent Variable	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (4)
ΔLY_t	-	0.15	1.05	1.29	0.06	3.33
ΔLK_t	0.01	-	0.26	5.86**	0.23	10.45
ΔLHC_t	0.46	0.00	-	1.00	0.001	1.72
ΔLEX_t	0.02	1.11	0.24	-	0.97	1.96
$\Delta LIMP_t$	0.02	3.87**	1.41	4.46**	-	13.45***

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively (df in parentheses). The lag length for the VAR is determined by minimizing the Schwarz information criterion (SIC). The diagnostic tests for the VAR model show that serial correlation is not present, while the residuals are homoscedastic, but not multivariate normal (BG χ2(25)= 0.16, BG χ2(25)= 0.71, JB (10)= 0.00, W-het χ2{300}= 0.22). In addition, the stability of the VAR is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 10: Short-run Granger causality test, Saudi Arabia

	Source of Causality					
	ΔLY_t	ΔLK_t	ΔLHC_t	ΔLEX_t	$\Delta LIMP_t$	*ALL*
Dependent Variable	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (8)
ΔLY_t	-	0.92	3.30	2.15	2.34	8.62
ΔLK_t	4.40	-	2.93	0.62	18.97***	22.86***
ΔLHC_t	1.75	0.15	-	4.78*	10.26***	16.66**
ΔLEX_t	0.20	0.11	0.68	-	0.33	2.69
$\Delta LIMP_t$	0.92	3.94	9.22***	0.63	-	14.73*

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively (df in parentheses). The lag length for the VECM is determined by minimizing the Schwarz information criterion (SIC). The diagnostic tests for the VECM[11] model show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG χ^2(25)= 0.03, BG χ^2(25)= 0.55, JB (10)= 0.98, W-het χ^2{375}= 0.24). In addition, the stability of the VECM is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 11: Short-run Granger causality test, UAE

	Source of Causality					
	ΔLY_t	ΔLK_t	ΔLHC_t	ΔLEX_t	$\Delta LIMP_t$	*ALL*
Dependent Variable	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (1)	χ^2 (4)
ΔLY_t	-	0.54	0.22	4.21**	1.01	5.68
ΔLK_t	0.47	-	5.52**	0.59	0.58	13.44***
ΔLHC_t	0.38	0.10	-	0.18	1.28	1.58
ΔLEX_t	0.14	0.18	0.58	-	0.07	1.37
$\Delta LIMP_t$	0.00	0.12	7.58***	0.19	-	11.63**

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively (df in parentheses). The lag length for the VECM is determined by minimizing the Schwarz information criterion (SIC). The diagnostic tests for the VECM model show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG χ^2(25)= 0.06, BG χ^2(25)= 0.69, JB (10)= 0.91, W-het χ^2{210}= 0.47). In addition, the stability of the VECM is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

The short-run causality results show that the null hypothesis of non-causality from exports to economic growth is rejected at the five percent and ten percent significance level for UAE and Kuwait respectively, indicating that the ELG hypothesis is valid in the short-run for the period 1975-2016. The null hypothesis of non-causality from exports to economic growth cannot be rejected at conventional levels of significance for the remaining countries. The null hypothesis of non-causality from economic growth to exports is rejected at five percent and ten percent significance for Kuwait and Bahrain respectively, indicating the GLE hypothesis is valid in the short-run. The null hypothesis of non-causality from economic growth to exports cannot be rejected at conventional levels of significance for the other countries. Therefore, the results provide evidence to support the validity of the ELG for the UAE, ELG-GLE for

[11] The VECM for Saudi Arabia is estimated with the inclusion of a step dummy variable for the year 1985, as the CUSUM plot of the initially estimated ECM for economic growth shows evidence of structural instability. In addition, the visual inspection of the plot of the economic growth variable confirms the inclusion of the step dummy variable. The estimated ECM without the inclusion of the dummy variable and the plot of the economic growth variable are not reported here, but are available upon request.

Kuwait[12], the GLE in Bahrain, while no evidence of causality is found for Oman or Saudi Arabia[13].

The results for UAE may be due to the role of increased exports in fostering technological innovation through increased investment and improved productivity (Balassa, 1978; Ramos, 2001; Al-Yousif, 1997; Kalaitzi and Chamberlain, 2020a). In the case of Kuwait and Bahrain, economic growth may cause an increase in exports, by increasing national production and the country's capacity to import capital equipment, improving the existing technology (Kindleberger, 1962). At the same time, in the case of Kuwait, increased exports may increase foreign exchange earnings, leading to further economic growth.

The absence of short-run causality between exports and growth for Oman and Saudi Arabia may be due to the fact that oil exports in these countries constitute a large share of merchandise exports. Oil exports are subject to excessive price fluctuations, have inelastic demand in the international market and do not offer knowledge spillover effects to the rest of the economy (Herzer et al., 2006; Kalaitzi and Cleeve, 2018; Kalaitzi and Chamberlain, 2020a; Kalaitzi and Chamberlain, 2020b). At the same time, if oil export revenues are directed towards increasing oil production and not non-oil production, the effect of oil exports on economic growth will be negligible.

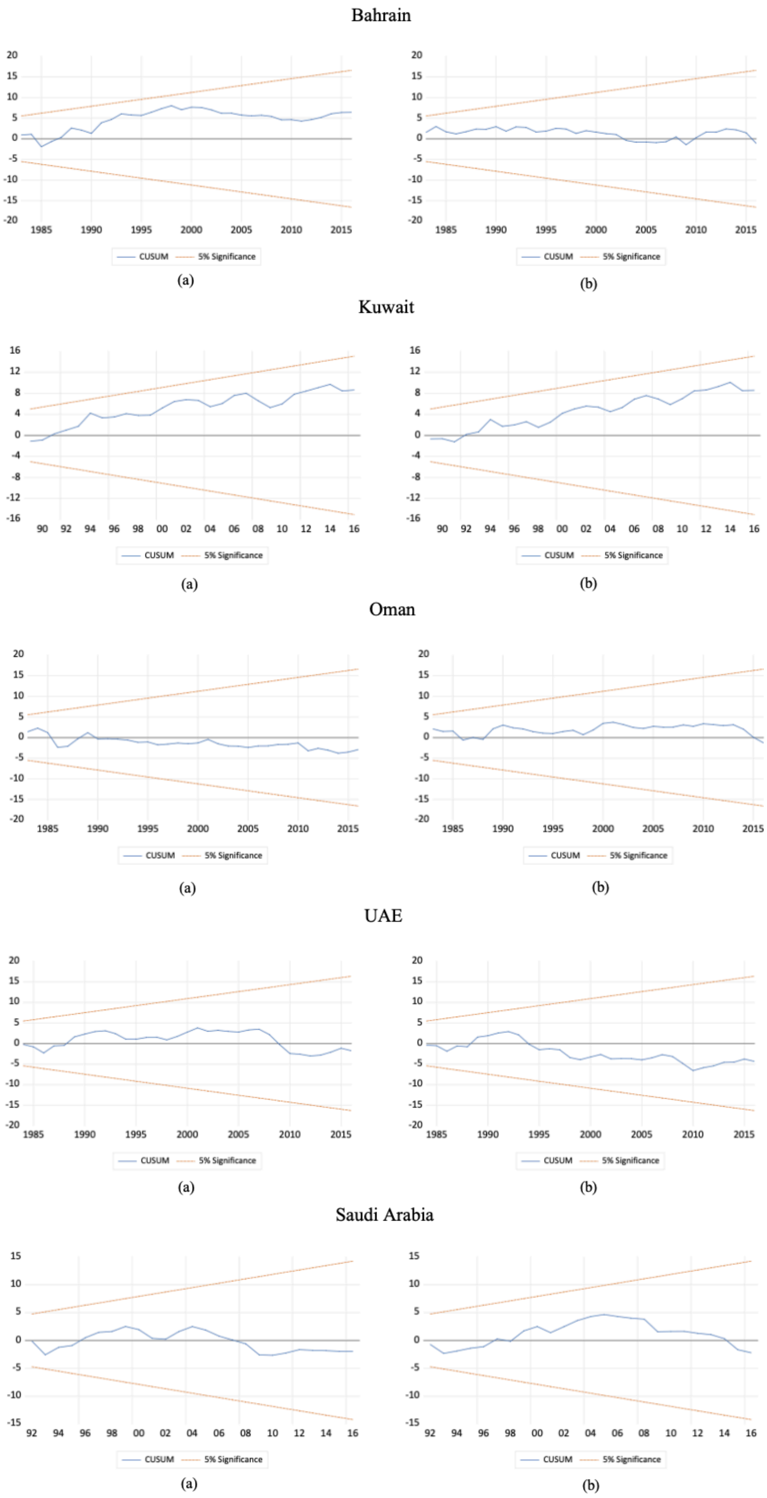
Since the aim of this paper is to find the direction of the causality between exports and economic growth, focus is placed on the structural stability of the parameters of the estimated models[14] for ΔLY_t and ΔLX_t for each country (eqs. (10), (13) for Bahrain; Kuwait, Saudi Arabia and the UAE; and eqs. (5), (8) for Oman). The estimated CUSUM statistics are plotted in Figure 1 together with the 5% critical lines of parameter stability. The CUSUM plots ((a) for economic growth and (b) for exports) show that there is no movement outside the 5% critical lines. Therefore, the estimated models for economic growth and exports are stable even during periods of oil price volatility.

[12] For Kuwait, the ELG and GLE hypotheses are valid ($p < 0.10$ and $p < 0.05$ respectively), indicating that a bi-directional causality exists between exports and economic growth. In this case, the wavelet method can be used to re-examine the direction of the causality in time and frequency domains, indicating which one is exact (Koltuniak, 2016 a-b; Aguiar-Conraria and Soares, 2011a–b; Ciesielska and Kołtuniak, 2017).

[13] Our analysis also finds that the null hypothesis of joint non-causality from physical capital, human capital, exports and imports to economic growth is rejected at the five percent and one percent levels for Bahrain and Kuwait, respectively. At the same time, the null hypothesis of joint non-causality from LY_t, LK_t, LHC_t and $LIMP_t$ to exports is rejected at one percent level for Kuwait.

[14] The diagnostic tests reveal that the residuals are multivariate normal and homoscedastic and there is no evidence of serial correlation. Diagnostic tests are available upon request.

Figure 1: CUSUM plots for the estimated ECMs for economic growth (a) and exports (b).



4.4 Long-run Granger Causality Test Results

In order to examine the long-run causality, the selected lag length (*p*) for each VAR model at levels is augmented by the maximum order of integration (*dmax*), and the Wald test is applied to the first p VAR coefficients. The results are presented in Tables 12 to 16.

Table 12: Causality based on the Toda-Yamamoto procedure, Bahrain

	Source of Causality					
	LY_t	LK_t	LHC_t	LEX_t	$LIMP_t$	ALL
Dependent Variable	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (8)
LY_t	-	1.09	11.81***	7.07**	8.04**	17.83**
LK_t	6.25**	-	9.04**	0.87	2.34	15.26*
LHC_t	0.27	4.75*	-	1.73	1.01	7.45
LEX_t	0.70	1.93	7.82**	-	4.07	16.71**
$LIMP_t$	0.05	1.67	2.51	2.07	-	5.45

Notes: *, ** and *** indicate significance at 10%, 5% and 1% significance respectively.
The diagnostic tests for the selected VAR(2) model prior to the application of the Toda-Yamamoto procedure show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG $\chi^2(25)$= 0.08, BG $\chi^2(25)$= 0.40, JB (10)= 0.73, W-het $\chi^2\{300\}$= 0.41). In addition, the stability of the VAR is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 13: Causality based on the Toda-Yamamoto procedure, Kuwait

	Source of Causality					
	LY_t	LK_t	LHC_t	LEX_t	$LIMP_t$	ALL
Dependent Variable	χ^2 (3)	χ^2 (3)	χ^2 (3)	χ^2 (3)	χ^2 (3)	χ^2 (12)
LY_t	-	10.50**	1.79	2.63	9.92**	30.34***
LK_t	2.56	-	3.66	10.44*	9.42**	27.88***
LHC_t	1.57	3.41	-	2.92	3.07	16.42
LEX_t	7.40*	10.58**	3.86	-	6.58*	42.48***
$LIMP_t$	1.53	0.39	1.64	6.27*	-	11.05

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively.
The diagnostic tests for the selected VAR(3) model prior to the application of the Toda-Yamamoto procedure show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG $\chi^2(25)$= 0.35, BG $\chi^2(25)$= 0.06, JB (10)= 0.51, W-het $\chi^2\{450\}$= 0.36). In addition, the stability of the VAR is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 14: Causality based on the Toda-Yamamoto procedure, Oman

	Source of Causality					
	LY_t	LK_t	LHC_t	LEX_t	$LIMP_t$	ALL
Dependent Variable	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (8)
LY_t	-	3.40	0.16	1.85	0.75	5.22
LK_t	0.60	-	0.23	4.04	0.66	9.60
LHC_t	0.63	1.92	-	0.06	1.55	4.93
LEX_t	1.12	0.12	1.74	-	1.69	3.76
$LIMP_t$	0.41	1.01	2.88	2.21	-	11.48

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively.
The diagnostic tests for the selected VAR(2) model prior to the application of the Toda-Yamamoto procedure show that serial correlation is not present, while the residuals are homoscedastic, but not multivariate normal (BG $\chi2(25)$= 0.66, BG $\chi2(25)$= 0.45, JB (10)= 0.00, W-het $\chi2\{300\}$= 0.04). In addition, the stability of the VAR is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 15: Causality based on the Toda-Yamamoto procedure, Saudi Arabia

	Source of Causality					
	LY_t	***LK_t***	***LHC_t***	***LEX_t***	***$LIMP_t$***	***ALL***
Dependent Variable	χ^2 (3)	χ^2 (3)	χ^2 (3)	χ^2 (3)	χ^2 (3)	χ^2 (12)
LY_t	-	0.23	1.24	2.43	1.98	15.89
LK_t	7.66*	-	1.88	1.11	3.13	17.42
LHC_t	12.22***	11.14**	-	11.80***	14.33***	33.39***
LEX_t	10.73**	1.97	5.60	-	5.33	23.36**
$LIMP_t$	1.25	1.04	9.83**	8.71**	-	21.01*

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively.
The diagnostic tests for the selected VAR(3) model prior to the application of the Toda-Yamamoto procedure show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG $\chi^2(25)$= 0.21, BG $\chi^2(25)$= 0.18, JB (10)= 0.99, W-het $\chi^2\{465\}$= 0.16). In addition, the stability of the VAR is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

Table 16: Causality based on the Toda-Yamamoto procedure, UAE

	Source of causality					
	LY_t	***LK_t***	***LHC_t***	***LEX_t***	***$LIMP_t$***	***ALL***
Dependent Variable	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (2)	χ^2 (8)
LY_t	-	4.17	1.65	2.53	5.03*	20.15***
LK_t	3.12	-	3.69	0.56	2.10	19.64**
LHC_t	0.95	1.46	-	0.91	1.33	10.52
LEX_t	0.25	2.26	0.26	-	2.42	14.66*
$LIMP_t$	1.09	1.08	7.77**	1.81	-	15.40*

Notes: *, ** and *** indicate significance at 10%, 5% and 1% respectively.
The diagnostic tests for the selected VAR(2) model prior to the application of the Toda-Yamamoto procedure show that serial correlation is not present, while the residuals are multivariate normal and homoscedastic (BG $\chi^2(25)$= 0.19, BG $\chi^2(25)$= 0.42, JB (10)= 0.44, W-het $\chi^2\{300\}$= 0.55). In addition, the stability of the VAR is confirmed based on calculations of the inverse roots of the characteristic AR polynomial.

The long-run Granger causality results show that the null hypothesis that LEX_t does not Granger cause LY_t cannot be rejected at any conventional significance level for the countries under consideration, except for Bahrain. In contrast, there is evidence to support the converse in the case of Kuwait and Saudi Arabia, as the null hypothesis of non-causality from LY_t to LEX_t can be rejected at ten and five per cent respectively. In addition, indirect long-run causality runs from exports to economic growth through imports and physical capital in the case of Kuwait. Thus, the Toda-Yamamoto procedure provides evidence to support the validity of the ELG in the case of Bahrain and of the GLE hypothesis in the case of Kuwait and Saudi Arabia, while no causality exists between exports and economic growth in Oman and UAE[15].

[15] Our analysis also finds that the null hypothesis of joint non-causality from LK_t, LHC_t, LX_t and $LIMP_t$ to economic growth is rejected at the five percent level for Bahrain, and at one per cent for Kuwait and UAE. At the same time, the null hypothesis of the joint non-causality from LY_t, LK_t, LHC_t and $LIMP_t$ to exports is rejected at conventional levels for all countries except Oman.

The results for the validity of the ELG hypothesis for Bahrain, directly, and for Kuwait, indirectly, show that exports growth increases investments, leading to technological improvement, increased productivity and economic growth in the long-run. Specifically, in the case of Kuwait, productivity will be enhanced by increased investments and imports expansion, which is considered to be a major channel for knowledge diffusion and technology transfer (Coe and Helpman, 1995; Keller, 2000). Also, imports expansion can provide the essential material for domestic manufacturing, leading to higher productivity and economic growth. As for the results indicating no causality between exports and economic growth, oil exports may be offsetting the impact of other categories of merchandise exports inasmuch as the former is subject to excessive price fluctuations and does not offer knowledge spillovers (Herzer et al., 2006; Kalaitzi and Cleeve, 2018; Kalaitzi and Chamberlain; 2020a; Kalaitzi and Chamberlain, 2020b).

5. Conclusion

The present study provides evidence on the relationship between merchandise exports and economic growth for Bahrain, Kuwait, Oman, Saudi Arabia and the UAE over the period 1975-2016. The cointegration results confirm the existence of long-run relationships among the variables under consideration for all countries except Oman. The short-run Granger causality results support the validity of the ELG hypothesis for the UAE, the ELG-GLE hypothesis for Kuwait, the GLE hypothesis for Bahrain and no causality between exports and economic growth for Oman and Saudi Arabia. The results are partially consistent with those of Al-Yousif (1997) and in contrast with the results of El-Sakka and Al-Mutairi (2000). Differences in results may be due to the period examined, the choice of variables, the lag length selection and the methods used in the estimation.

As for long-run causality, the results provide evidence to support the ELG for Bahrain, the GLE hypothesis for Kuwait and Saudi Arabia, and no causality between exports and economic growth for Oman and the UAE. The non-existence of the ELG hypothesis in the long-run for all countries except Bahrain, may be due to the large share of fuel exports in total merchandise exports (Herzer et al., 2006; Kalaitzi and Cleeve, 2018; Kalaitzi and Chamberlain, 2020b).

The study's findings should be of interest to policy makers in the GCC as their states move away from a dependence on fossil fuel exports and devise development strategies in keeping with their 2016 pledge to the United Nations' 2030 Agenda for Sustainable Development (see Al-Saidi, Zaidan and Hammad (2019) for a history of sustainable development in the GCC). Diversification into non-fuel exports may also open up channels for building economies of scale and gaining access to new technology and knowledge. An important challenge will be to determine what form diversification should take and, in particular, what export industries should be promoted in order to foster sustainable economic growth.

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Appendix

Table A1: Real GDP Annual Growth Rate (%)

	GDP growth rate (%)				
	1975-1985	1986-1995	1996-2005	2006-2016	1975-2016
World	3.2	2.9	3.3	2.7	3.0
MENA	1.2	3.8	4.1	3.8	3.2
High Income	3.1	2.9	2.8	1.5	2.6
Bahrain	5.6	5.8	4.7	4.5	5.1
Kuwait	-1.3	8.6	5.4	2.4	3.8
Oman	10.4	3.5	2.1	4.9	5.3
Saudi Arabia	-1.4	5.3	2.9	3.8	2.6
UAE	8.4	3.6	5.5	3.8	5.3

Source: Authors' calculation based on World Development Indicators, World Bank

Table A2: Real Exports Growth Rate (%)

	Exports growth rate (%)				
	1975-1985	1986-1995	1996-2005	2006-2016	1975-2016
Bahrain	3.0	5.0	4.7	1.1	3.4
Kuwait	-4.5	49.2	9.1	0.3	13.1
Oman	11.3	7.3	5.1	0.9	5.3
Saudi Arabia	-7.4	10.1	9.2	-1.0	2.3
UAE	7.5	5.6	10.6	6.5	7.5

Source: Authors' calculation based on World Development Indicators, World Bank