Journal of Economic Cooperation and Development, **45**, 4 (2024), 115-144

Diversifying Trade for Kuwait's Growth: Dynamic Panel Model Insights

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ABSTRACT

This paper examines the inter-linkages between manufacturing and high-technology exports on economic growth and diversification in Kuwait, a fossil-fuel exporting economy. The roles of exports, manufacturing-led growth, high-tech-led growth, and imports in growth sustainability are formally modeled using a rich panel dataset covering 56 emerging, developed, and developing countries from 1970 to 2020. Quantitative techniques, including generalized least squares (GLS), fixed effects modeling, and panel vector autoregressive (PVAR) analysis, are employed to test the direction and magnitude of causal linkages among technological innovation, trade diversification, and economic sustainability. Additionally, the paper explores the impact of modern seaports on fostering innovation, trade diversity, and sustainable growth. Policy recommendations are provided to guide Kuwait's future diversification and digitization efforts.

ملخص

تبحث هذه الورقة البحثية في الروابط المتشابكة بين التصنيع والصادرات ذات التكنولوجيا العالية وتأثيرهما على النمو والتنوع الاقتصادي في الكويت، بوصفها اقتصادا يعتمد على تصدير الوقود الأحفوري. وتمت نمذجة أدوار الصادرات والنمو القائم على التصنيع والنمو المدفوع بالتكنولوجيا المتقدمة والواردات في تحقيق استدامة النمو من خلال مجموعة بيانات لوحية

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شاملة تغطي 56 بلدا ناشئة ومتقدمة ونامية خلال الفترة من عام 1970 إلى 2020. وتم استخدام تقنيات كمية، تشمل المربعات الدنيا المعممة(GLS) ، ونمذجة التأثيرات الثابتة، وتحليل متجه الارتباط الذاتي اللوحي(PVAR) ، لاختبار اتجاه وحجم الروابط السببية بين الابتكار التكنولوجي وتنويع التجارة والاستدامة الاقتصادية. كما تتناول الورقة تأثير الموانئ البحرية الحديثة في تعزيز الابتكار وتنوع التجارة والنمو المستدام. وتُقدم توصيات على مستوى السياسات تهدف إلى توجيه جهود الكويت المستقبلية نحو التنويع والرقمنة.

RÉSUMÉ

Cet article examine les liens entre les exportations de produits manufacturés et de haute technologie sur la croissance économique et la diversification au Koweït, une économie exportatrice de combustibles fossiles. Les rôles des exportations, de la croissance tirée par l'industrie manufacturière, de la croissance tirée par la haute technologie et des importations dans la durabilité de la croissance sont formellement modélisés à l'aide d'un riche ensemble de données de panel couvrant 56 pays émergents, développés et en développement de 1970 à 2020. Des techniques quantitatives, notamment les moindres carrés généralisés (GLS), la modélisation des effets fixes et l'analyse vectorielle autorégressive (PVAR), sont utilisées pour tester la direction et l'ampleur des liens de causalité entre l'innovation technologique, la diversification des échanges et la viabilité économique. En outre, le document explore l'impact des ports maritimes modernes sur la promotion de l'innovation, la diversité des échanges et la croissance durable. Des recommandations politiques sont formulées pour guider les futurs efforts de diversification et de numérisation du Koweït.

Keywords: Exports; Diversification; Growth; Technological Innovation

JEL Classification: F10, O11, O14, O30

1. Introduction

This paper examines the inter-linkages between economic growth, innovations, export complexity, and economic diversification in Kuwait, a fossil-fuel exporting economy. Utilizing a dynamic panel vector autoregressive (PVAR) model and Granger causality tests, the study scrutinizes the nexus between trade diversification and economic resilience. The model incorporates the initial and evolving economic structure of the manufacturing sector and the steady changes in country exports, as reflected in real GDP at 2015 prices, across 56 emerging, developed, and developing countries from 1970 to 2020.

Existing literature suggests that diversifying the production structure of an economy, providing better access to infrastructure and services, and accumulating human capital are essential for fostering steady export diversification (Kalaitzi et al., 2023; Agosin et al., 2012; IMF, 2014). A significant strand of the literature examines these effects under the "trade-led growth" (TLG) hypothesis, which attributes trade-led growth to productivity gains from trade expansion, including knowledge spillovers, increased competition, learning-by-doing, access to foreign inputs, and skill upgrading for labor (Bárány and Siegel, 2020; Hijzen et al., 2013).

With the rapid penetration of digital and information technology, high-technology exports of goods and services are flourishing and overtaking manufacturing exports as drivers of trade-led growth (Baldwin, 2024). Accordingly, this study incorporates these trade variables as regressors to discern their respective effects on inter-country GDP performance within the context of the PVAR model. The derived lessons are especially pertinent to Kuwait and other resource-rich countries, which often have a clustered production structure and limited diversification (Gelb, 2010). These countries frequently face comparative disadvantages in terms of limited diversification and mild productivity growth, which constrain the extent of trade-led growth (Helpman et al., 2017).

In the GCC region, Mishrif (2018) discusses diversification strategies that each of the GCC countries has pursued over time, including the development of upstream oil and gas industries encompassing plastics and refined products. Hvidt (2013) argues that diversification from a single oil source to multiple production and revenue sources entails a well-articulated transformation of the economic base and the effective engagement of all population segments in the diversification process. More recently, Shadab (2023) explored the role of export diversification in fostering the UAE's Gross Domestic Product (GDP) growth. Her econometric findings provided robust evidence that export and economic diversification did indeed foster economic growth in the UAE both in the short and long run (Shadab 2023). Similarly, the fieldwork of (Al-Fulaij et al., 2022) premised on polling 100 CEOs of Kuwaiti export-import companies suggested that Kuwait's deep trade through oil export differentiation has had positive effects on economic growth through increased investment and imports. By and large, polled CEOs appraised the role of exports and imports in enhancing the use of technology in their own business operations. Furthermore, export-import CEOs believe that exporting firms have an edge in terms of innovation edge.

Conceptually, this paper is anchored on the interactive linkages between countries' economic complexity and product innovations blended with technological developments of the Hidalgo and Hausman complexity varieties who developed the Economic Complexity Index (ECI) (Hidalgo and Hausmann, 2009; Harvard Complexity Index, 2023). The ECI assesses the extent of the complexity of national economies in terms of product groups or the Product Complexity Index. With accelerating technological developments at rapid strides, a third complexity component is proposed to be combined with the economic and product dimensions: The Patent Complexity Index (PatCI). According to (Ivanova, 2017), patent complexity can be integrated into the other two components based on a matrix of nations versus patent classes. When technology, economy, and product complexities are combined, a third measure, dubbed "Triple Helix" complexity (THCI), connotes trilateral interaction terms between knowledge production, wealth generation, and (national) control. THCI can be expected to capture the extent of systems integration between the global dynamics of markets (ECI) and technologies (PatCI) in each national system of innovation (Ivanova et al., 2017).

Empirically, this paper tests two interrelated hypotheses. The first hypothesis is that trade, encompassing exports and imports, positively affects economic growth through channels such as export diversification, efficiency gains, and product innovation. The second hypothesis posits that manufacturing exports, along with high-tech exports of goods and services, steadily fuel economic growth (OECD, 2024; Baldwin, 2024). The study examines the Granger causality direction between high-technology exports, manufacturing exports, imports, and economic growth. In the process, drawing on lessons from international emerging countries, the paper explores the role of modern Kuwait's seaports in maritime trade and their comparative developmental impact on trade diversity.

The paper is structured as follows: The remainder of this section reviews the literature. Section 2 introduces the data and methodology. Findings are presented in Section 3, and their implications are discussed in

Section 4, along with highlights of key lessons learnt. The last section is a summary and conclusion.

2. Literature Review

2.1. Export Diversification and Economic Growth

Conventional trade analysis prescribes integration into the international market as a panacea for the limited market size and for the benefits associated with economies of scale and learning from more innovative trading partners. Recently, however, a strand of trade literature posits the analytical view that strategies of export-led growth often led to a disproportionate allocation of resources towards export-oriented industries through an array of industrial national policy measures such as subsidies and tax incentives. In China, for example, low spending is driven by high savings rates necessitated by weak welfare systems, including poor public health, education, retirement, and aged care systems (Hoffman, 2024).

As an alternative, the literature posits that strategies of expanding domestic demand through income-redistribution ought to be pursued in parallel with trade policies that forge preferential multilateral trade agreements with and among friendly nations. Such policies result in expanded domestic market size, which can partially compensate for the lack of international markets (Goldberg and Reed, 2023). In commenting on these domestic market and preferential trade expansion policies, Dani Rodrik notes that "the authors are right that we are entering a different global context where the world economy will play a lesser role for most developing nations. Technological change and the backlash against globalization are making East Asia-style export-oriented industrialization much more difficult to achieve." (Rodrik, 2023). These policy perspectives have relevance to the fossil-fuels exports economy of Kuwait with its policy drive to diversify away from oil into a digital economy. According to Hvidt (2013), diversification entails a broad societal process, which transfers a country from a single source of income (oil and gas) to a society where multiple sources of income are generated across the primary, secondary and tertiary, and where large sections of the population, including public and private enterprises, participate in the development process. The transition would imply, by necessity, increasing the high tech-capabilities and creativity of its population and workforce through intensive innovative training and learning coupled with the increased size of domestic and regional market demand for increasingly complex products and services.

Contemporaneous lessons learned from Asia Trade partners indicate that export diversification and integration among Asian trading partners deepen in niche areas, including new technology and digital connectivity, environmental cooperation, trade linkages, investment, and value chain participation (ADB,2022). Accordingly, developing countries need to nurture domestic innovation capabilities and expand domestic demand in tandem with diversifying their exports. However, such an effect is not the same as in the most advanced countries that perform better with export specialization (Hesse, 2009). Still relevant to resource-rich economies like Kuwait, the most critical impact of diversification is that it performs better in the long term while recognizing the possibility that net resource exporters tend to achieve slower rates (Gelb, 2010; Lederman and Maloney, 2006).

Lessons can still be learned from the rapid success of the Asian miracles in achieving fast and sustained economic growth (Arman and Al-Qudsi, 2022). Transitioning swiftly from import substitution to an export-oriented approach enabled these countries to expand exports, boost the inflow of foreign exchange and imports, and increase productivity (Chenery, 1967; Gylfason, 1999; McKinnon, 1964). However, low-value exports, such as those from commodity-dependent economies like oil-exporting countries, can lead to episodic economic growth due to excessive price fluctuations. These types of exports do not offer knowledge spillovers and positive externalities to non-export sectors as manufactured exports do (Herzer et al., 2006; Kalaitzi and Cleeve, 2018).

Another key aspect for developing countries is trade-driven technology transfer, which plays a vital role in improving productivity and contributing to economic growth. However, the effectiveness of this transfer can vary depending on the context (Coe and Helpman, 1995; Henry et al., 2009; Keller, 2000).

In the traditional trade theory, causation runs from productivity to trade patterns, where only the most productive firms become exporters and not the other way around (Melitz, 2003). However, at the aggregate level, causation can run both ways in a Melitz model, depending on the nature of the shock (Cadot et al., 2013). Export diversification can reduce vulnerability to trade shocks and stabilize export revenues, so there is a growth and stability payoff to diversification (IMF, 2014). However, natural resource-rich countries and small economies like Kuwait have unique characteristics that may need different analytical treatment. Countries vary in terms of export growth determinants; for instance, estimates from Latin American countries showed that transport costs could significantly impact the expansion of the number of products exported (Mesquita Moreira et al., 2013). Similar logistics challenges for African countries where exports are highly concentrated in mineral resources, a limited number of primary products and widespread unemployment. To this point, UNCTAD (2018) showed a strong link between export-concentration countries and the lack of job opportunities and high unemployment. As ascertained by the OECD and WTO, no single formula can promote diversification and the time-increase in employment--every country follows a different path (Huria and Brenton, 2015; OECD and World Trade Organization, 2019).

2.2. Export Diversification and Technological Innovation

Many empirical studies using firm-level data have examined the relationship between trade and innovation, resulting in different views depending on the type of innovation measures, countries, and methodologies (Van Beveren and Vandenbussche, 2010). Micro-level empirical studies showed that there is a positive relationship between innovation and exporting, where the variety of innovation and marketing innovation is important (Rodil et al., 2016). Becker and Egger (2013) distinguished between the effect of product and process innovations on export. They concluded that both types of innovations increase exports, with an edge for product innovation to enter the export market, whilst process innovation is for sustaining that market. As suggested by the literature on a macro level, imports can also contribute significantly to advancing firms' technological capabilities and enhancing their export ability (Mazzi and Foster-McGregor, 2021).

In a study using dynamic panel data models of a sample of 19 developing countries, the results showed that what matters in terms of growth is the high-tech and imports capital goods imports and not the export diversification (Carrasco and Tovar-García, 2021). The stage of development for countries can be key in explaining the role of diversification and specialization. According to Imbs and Wacziarg

(2003), countries diversify during the early stage of development and then specialize, perhaps to close the technological gap and excel and innovate in specific niches. A recent cross-country study (the BRICS), using several cointegration techniques, explored the relationship between export and growth for the period 1995-2017, and concluded that the BRICS countries have crossed their "inflexion point" of development and need to re-specialize their export baskets. This explains why export concentration has positively impacted growth (Siswana and Phiri, 2021). Moreover, specializing in some products can bring higher growth than specializing in others, which highlights the critical role of government policies in shaping the production structure (Hausmann et al., 2007).

Significantly, a study which covered 34 countries over the period 1995-2015 and which applied dynamic panel data modeling techniques revealed that exports of high-technology products have robust positive impact on economic growth for upper-middle-income countries (Demir, 2018). However, when encompassing a larger set of countries with different sizes and development stages but similar period (1992-2014), the high-tech exports had less impact on growth than the non-high-tech exports (Ekananda and Parlinggoman, 2017). So, it seems combining a large sample of different countries might not lead to solid or easy-to-explain results. The country's development grouping can offer a resolution to such a dilemma. This was evident in the cross-country study of a sample of 86 countries over the time period 1970–2009 that used regression tree analysis as a sample-splitting technique to identify possible economic development thresholds in the relationship between the level of manufacturing exports and GDP per capita growth. The results highlighted the importance of human capital as an enabler for developing countries to move from primary exports to manufacturing exports (Sheridan, 2014).

3. Data and Methodology

A compendium of rich data comprises our sample, which is listed below. The sample embeds a suite of trade and growth variables such as GDP, exports, imports, manufacturing and high-tech exports and imports, investment, trade openness, and inflations, among others. Stretching over 1970-2020 the sample covers 56 countries with diversity across endowments, trade openness, and resources. From advanced economies our sample includes Austria, Canada, Estonia, Finland, France, Germany, Greece, Israel, Italy, Japan, Korea (Rep.), Netherlands, Norway, Portugal, Singapore, Spain, United Kingdom, and the United States. The Commonwealth of Independent States (CIS) is represented by the Russian Federation, and Emerging and Developing countries are represented by Albania, China, India, Indonesia, Latvia, Malaysia, Mexico, Pakistan, Philippines, Thailand, Turkey, and Vietnam. Latin America and the Caribbean countries included are Argentina, Brazil, Chile, Ecuador, and Venezuela. The sample also covered (MENA) countries of Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates. Finally, the Sub-Saharan Africa category includes Angola, Kenya, Nigeria, South Africa, and Sudan

Methodologically, the paper applied fixed effect modelling, using the GLS approach to the sample (56 countries) covering 50 years (1970–2020). The specifications of the PVAR model that is used for the subsequent empirical work are based on the consideration of variables which hypothesize that GDP is a function of; that is, exports, imports, high-technology exports, and manufactured exports. The underlying hypothesis is that Gross Domestic Product (GDP) is a function of export flows EXP, flows of high-tech exports HITX, manufacturing export products $MANX$, and import flows IMP:

$$GDP_t = F(EXP_t, HITX_t, MANX_t, IMP_t) \quad (1)$$

This formulation is premised on vast empirical literature revealing the ability of emerging countries to rise to the level of developed countries depends on the scale of high manufacturing exports and technology and information technology exports that these countries can achieve (Kabaklarli et al., 2018; Hausmann, 2024; Baldwin & Forslid, 2023).

Mathematically, we consider K- variate homogeneous panel vector autoregression of order P with panel-specific fixed effects represented by the following system of linear equations (Abrigo and Love 2016; Ajao and Adenomon 2023):

$$Y_{it} = Y_{it-1}A_1 + Y_{it-1}A_2 + Y_{it-3}A_3 + ... + Y_{it-p+1}A_{p-1} + Y_{it-p}A_p + U_i + e_{it}$$
$$\mathcal{E}\{1, 2, \ldots, N\}, t\mathcal{E}\{1, 2, \ldots, T_i\} \quad (2)$$

Therefore, we consider the following stationary PVAR with fixed effects.

$$y_{i,t} = \mu_i + \sum_{i=1}^{p} A_i y_{i,t-1} + Bx_{i,t} + Cs_{i,t} + \epsilon_{i,t} \quad (3)$$

I_m Denotes an $m \times m$ identity matrix. Let $y_{i,t} \epsilon R^m$ be a $m \times 1$ vector of endogenous variables for the ith cross-sectional unit at time t. Let $y_{i,t-l} \epsilon R^m$ be a $m \times 1$ vector of lagged endogenous variables. Let $x_{i,t} \epsilon R^k$ be a $k \times 1$ vector of predetermined variables that are potentially correlated with past errors. Let $s_{i,t} \epsilon R^n$ be a $n \times 1$ vector of strictly exogenous variables that neither depend on ϵ_t nor on ϵ_{t-s} for$s$ =1 . . . T. The idiosyncratic error vector $\epsilon_{i,t} \epsilon R^m$ is assumed to be well behaved and independent from both the regressors $x_{i,t}$ and $s_{i,t}$, also the individual error component μ_i . Stationarity requires that all unit roots of the PVAR model fall inside the unit circle, which, therefore places some constraints on the fixed effect μ_i. The cross-section i and the time section t are defined as follows: i = 1, 2, ..., N and t = 1, 2, ..., T. In this specification, we assume parameter homogeneity for $A_{l(m\times m)}$, $B_{(m\times k)}$, and $C_{(m\times m)}$, for all i.

Besides endogenous and lagged variables, three variables are treated as exogenous in estimating the panel var model. These are the ratio of investment to gross domestic product, the size of trade openness (exports plus imports in percent of GDP), and the inflation rate. The model is estimated in Stata environment. To avoid the problem of correlation between fixed effects and regressors, we use forward mean differencing (FOD) which specifies that the panel-specific effects be removed using the forward orthogonal deviation Helmert transformation procedure (Holtz-Eakin et al., 1988; Arellano & Bover,1995). The coefficients of the PVAR model are estimated using the system generalized method of moments (GMM-style) (Blundell & Bond, 1998).

4. Analysis and Results

The authors first test for cross-sectional dependence (CD) by testing the amassed compendium of international data. Upon its detection, the Generalized Least Squares approach is applied to a fixed effect model of high-tech exports. Subsequently, the analysis deploys a formal panel; the compendium of data that is amassed for this study is generated mostly from international sources, including the online databases of UN statistics and the World Bank Development Indicators. The number of observations of each variable is shown in Table 1. Unfortunately, variables on high-tech exports and manufactured exports are least complete in the entire sample, which contrive the data size for estimation purposes. Table 1 provides a concise summary of the number of observations, means, standard deviations and other descriptive stats on a select set of variables that the study here utilizes.

Table 1: Descriptive Statistics of a Set of Panel Data Variables (Log Form, USD)

Variable	Obs	Mean	Std.Dev.	Min	Max
GDP15	2588	12.28643	1.79333	8.168	18.2534
Manuf exports	1745	13.870	2.492	2.424	20.661
Exports 15	2276	10.883	1.769	4.930	17.010
Imports 15	2276	10.938	1.715	5.459	16.987
High tech exports	1471	7.035	3.806	-6.908	14.884
Debt/GDP	1995	52.712	39.320	0.004	454.864
Investment/GDP	2541	23.78305	7.157903	0	89.386
Deflator GDP	2638	24.26256	165.0261	-30.2	4800.532

In the Appendix, tests were applied to check the hypothesis that there is no cross-sectional dependence across country regressions. The check is tantamount to testing that panels are homoscedastic or free of dependence of cross-sectional errors (see the Appendix for the list of tests conducted). To determine the optimal lag length, the paper applied the Schwartz Information Criteria (SIC) and the Akaike Information Criteria (AIC). The SIC criteria suggested a lag length of 1, whereas AIC suggested the optimum lag order is 2. However, since SIC criterion is generally considered more robust for large samples, the authors decided to run its model using lag length of 1, but prudentially it also ran an alternative PVAR with lag length of 2. However, these varieties did not seem to change the overall results in terms of causality and model stability.

Geopolitical, financial, and climate-caused shocks are rampant in today's global economy, which often spillover to other countries and regions. This is especially true if the affected economy has a large share in the global economy and or is strategically located, Turkey for example, or is a heavy consumer or producer of goods and services such as China, Singapore, South Korea, or KSA. Such likely inter-dependence and spillover effect cause econometric estimates derived from the panel data model to be not robust because their cross-sectional error terms embed the effect of cross-section dependency, as noted by Chudik and Pesaran (2015). Accordingly, testing for cross-section dependence in our data is merited. Cross-sectional dependency tests displayed in the Appendix indicate the acceptance of the CD hypothesis in the 56-country data with a high significance level. In addition to using panel unit root as proposed by Pesaran (2021), the paper deploys PVAR model that removes common cross-section means from each variable, as suggested by (De Hoyos and Sarafidis, 2006).

4.1. Role of Exports and High-Tech Exports in the Trade-Technology-Economy Paradigm

The seminal work of Hidalgo and Hausmann (2009), which led to the development of Harvard's Atlas of Economic Complexity, is both conceptually and empirically robust. Their research suggests that countries tend to converge to the level of income dictated by the complexity of their productive structures, implying that development efforts should focus on creating conditions that allow complexity to emerge, thereby generating sustained growth and prosperity.

The GCC countries, including Kuwait, are in the early stages of producing high-tech exports that significantly impact their growth trajectories. Hidalgo and Hausmann (2009) predicted that if deviations from an innovative path continue, future growth and trade will likely be shallow and based on natural resources rather than brainpower-developed products. Consequently, Kuwait's innovation in export products is below its potential and falls short of the export product diversification achieved by other oil-resource economies and emerging innovators like Malaysia, Thailand, and South Korea.

The findings of this study corroborate recent literature demonstrating that Kuwait's labor and total factor productivity lag behind. The existing welfare-state wage policy distorts the relationship between effort and rewards, inadvertently causing overall wages, especially public sector wages, to grow at rates double the rate of productivity growth (Al-Qudsi et al., 2021).

Mounting empirical evidence overwhelmingly implicates the distortive effect of the wages and incentives policy. Unintentionally, they inhibited innovations in export diversification, and therefore, the government's wage and incentives policy is the main culprit for Kuwait's contrived number and value of innovative export diversification. Our PVAR model was estimated by removing the cross-sectional mean from the dependent variable and in the repressors (Table 2).

Table 2. Results of Estimating the Trade-Technology-Growth Linkages, PVAR Model

GMM estimation; Number of obs. = 1105, Number of groups = 49, Avg observations per group = 22.55

Variable	**lngdp15**	**lnexport15l1**	**lnhitchexpl1**	**lnmanexpr1~1**	**lnimport15l1**
L.lngdp15	0.503*** (5.86)	0.602*** (5.53)	-3.619*** (-3.53)	0.470* (2.01)	0.481* (2.36)
L.lnexport~1	0.0936** (3.15)	0.940*** (23.41)	1.433*** (3.54)	-0.105 (-0.90)	0.108 (1.62)
L.lnhitche~1	0.0411*** (5.23)	-0.0327*** (-3.33)	1.064*** (9.64)	0.0245 (0.78)	0.00554 (0.31)
L.lnmanexp~1	0.0323 (1.72)	-0.019 (-0.73)	0.845*** (3.35)	0.776*** (13.08)	-0.104* (-2.40)
L.lnimport~1	0.0811*** (3.37)	-0.267*** (-7.79)	0.121 (0.42)	-0.129 (-1.88)	0.621*** (10.77)
Investtogdp	0.0000228 (0.02)	0.0112*** (6.71)	0.0301 (1.89)	0.000579 (0.14)	0.0168*** (5.40)
trade%gdp	-0.000669 (-1.57)	0.00287*** (5.74)	0.00384 (0.79)	0.00109 (0.70)	0.00302** (2.76)
def	0.0000259*** (3.52)	-0.0000474** (-3.15)	-0.000121 (-0.97)	0.0000312 (1.02)	-0.0000269 (-0.85)

Exogenous variables are investment to GDP, trade openness (%of GDP) and GDP deflator.
t statistics in parentheses *p<0.1, **p<0.05, ***p<0.01

Briefly, the model findings reveal that GDP at lag 1 and total exports as well as manufacturing exports at lag 1 are powerfully significant and positively related to GDP: A unit increase in GDP at lag 1 causes GDP to increase by 0.503 per unit increase in GDP at lag 1 while a unit increase in total exports at lag1 causes GDP to increase by a unit of

0.094 at lag 1. High-tech exports are a significant contributor to GDP, with a unit increase in high-tech exports causing GDP to increase by .041 GDP units at lag 1. While manufacturing has a positive contribution, the estimate lacked statistical significance. A unit increase in imports at lag 1 causes GDP to increase .081 units at lag 1.

The findings provide support for the that trade-led growth hypothesis in the case of 56 countries over 1970-2020. Meanwhile, high-tech and manufacturing exports have respectively strong and positive effect on GDP and on its dynamic change. Likewise, imports induce positive change to GDP, corroborating the hypothesis of trade-led growth.

Since all the modulus value in Eigenvalue are less than one (1), therefore PVAR satisfies stability condition, Figure 1.

Figure 1: Roots of the companion matrix

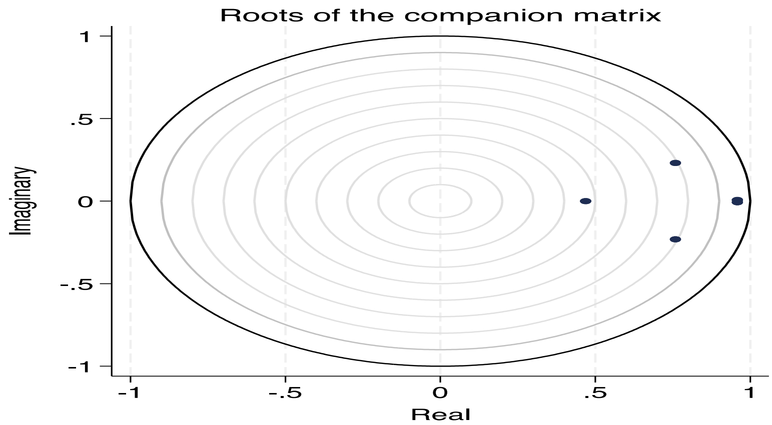


Table 3: Testing the Stability of the PVAR Model

Eigenvalue		
Real	**Imaginary**	**Modulus**
0.9585	-0.0069	0.95853
0.9585	0.00693	0.95853
0.75859	-0.2313	0.79307
0.75859	0.2313	0.79307
0.46914	0	0.46914

4.2. Granger Causality Tests and Robustness of Findings

Based on the findings of the PVAR Model, results of the Granger causality tests are derived for all variables in the whole model and in each of its blocks (Table 4). They provide systematic proof of the robustness of the hypotheses about the direction of causality between trade, manufacturing exports, high tech exports and economic growth.

Table 4: Granger Causality Tests

Equation	Excluded	Chi2	Df	Prob > chi2
lngdp15				
	lnexport15l1	9.927	1	0.002
	lnhitchexpl1	27.373	1	0
	lnmanexpr15l1	2.965	1	0.085
	lnimport15l1	11.379	1	0.001
	ALL	34.711	4	0
lnexport15l1				
	lngdp15	30.557	1	0
	lnhitchexpl1	11.089	1	0.001
	lnmanexpr15l1	0.537	1	0.463
	lnimport15l1	60.689	1	0
	ALL	63.593	4	0
lnhitchexpl1				
	lngdp15	12.447	1	0
	lnexport15l1	12.543	1	0
	lnmanexpr15l1	11.229	1	0.001
	lnimport15l1	0.175	1	0.675
	ALL	19.96	4	0.001
lnmanexpr15l1				
	lngdp15	4.054	1	0.044
	lnexport15l1	0.817	1	0.366
	lnhitchexpl1	0.614	1	0.433
	lnimport15l1	3.541	1	0.06
	ALL	14.964	4	0.005
lnimport15l1				
	lngdp15	5.579	1	0.018
	lnexport15l1	2.622	1	0.105
	lnhitchexpl1	0.098	1	0.754
	lnmanexpr15l1	5.767	1	0.016
	ALL	46.412	4	0

Panel VAR-Granger causality Wald test

Ho: Excluded variable does not Granger-cause Equation variable

Ha: Excluded variable Granger-causes Equation variable

Exports, measured in real terms, are proven to be Granger cause of real GDP variability in the constructed panel of 56 countries. So, the thesis of exports-led growth apparently holds in the context of the 56-country sample deployed in the analysis herein. Exports' growth and diversity do contribute to the country's growth complexities. Likewise, increased GDP growth exerts a strong positive impact on export diversification. Therefore, the PVAR model findings strongly support the hypothesis of two-way causality between exports and growth; that is, exports' Granger cause growth and, reciprocally, GDP growth, so Granger causes exports' expansion and diversity.

A second very powerful conclusion that is borne out by the model findings pertains to the dynamic role of innovative technology in producing high-tech export products. The finding is in line with the work of (Hidalgo and Hausmann, 2009; Ivanova et al., 2017) block constructs since the hypothesis that high-tech exports Granger cause economic growth is strongly and robustly validated by the dynamic panel model findings of this paper. Manufacturing exports also positively influence GDP growth. Unequivocally, the first block of the PVAR model results of Table 4 indicates that as new tech products are innovated and exported, they do Granger cause GDP growth differentials. Accordingly, there is a strong causal relationship between exports of high-tech products and GDP growth. The findings consequently demonstrate technology to exert a powerful driving force that determines growth differentials across countries. Simply stated: High-tech exports Granger causes economic growth.

Third, concerted developmental efforts that nurture the manufacturing sector positively influence high-technology exports, exert a positive effect on total exports and on GDP growth, and thereby provide a strong impetus for economic growth and its differentiation across countries over time. Manufactured exports are in turn positively influenced by the increases in GDP and imports and are apparently a strong driver of economic growth.

In addition to exports, high-tech exports and manufactured exports, the model shows that imports do Granger cause economic growth and positively influence GDP, total exports and manufactured exports. Therefore, the policy implication is that concerted efforts should be invested in expanding the exporting potential of high-tech products while maintaining imports within bounds that foster exports' growth through importing raw material, capital goods and associated know-how. Fostering the manufacturing sector's products has a powerful positive effect on the exports of high-technology products and, accordingly, is a strong bridge for the transformation to more high-tech exports.

Since imports provide a suite of essential products, equipment, and tools that become inputs in the production of high-tech exports, the model findings indicate that imports exert an influential and positive effect on the increase of manufactured exports. Reciprocally, the model findings the fifth block suggest that manufactured exports wield a powerfully positive impact on imports. Similarly, temporal and inter-country growth differentials Granger cause observed differences in imports across time and between the 56 countries.

Economic complexity growth gauged by real GDP growth translates into a positive effect on increased high-tech exports as well as on manufactured export products. Likewise, imports do play a positive role in the elevation and transformation of the manufacturing sector, which together with high-tech exports, is a horsepower of the economy for diversifying into innovative products for the export market.

Finally, GDP growth and manufacturing export growth are positive contributors to the expansion of imports across countries and over time. These two variables come out as robustly Granger causing of imports. For the future of Kuwait, the findings strongly support the case of upskilling its labor force to apply innovations in order to generate manufactured and high-tech products, including complex manufactured oil and gas innovations, that can be competitive in the international markets and hence can help Kuwait foster its growth sustainability currently and during the energy-transition to the digital economy.

Findings of the PVAR model are in congruence with the Hausmann team contained in the Harvard Atlas (2023), which strongly supports that Kuwait ought to invest and leapfrog and diversify into the production of innovative products for exportation and specialization. Table 5 summarizes the PVAR model findings anchored against the ranking and policy takeaways of the Harvard's pathway to diversification into new products for exports, new exports products, along with Kuwait's rank on the Harvard Economic Complexity Index.

Table 5. Kuwait's Ranking on Harvard Economic Complexity Index and Diversification into New Products

Country	**Economic Complexity Index (ECI) ranking ECI Rank 2020**	**Diversification into New Products New Export Products, 2005 - 2020**		
		New Products	**USD per Capita**	**USD (Total Value)**
Kuwait	86	4	300	$1.28B
Saudi Arabia	42	19	161	$5.59B
United Arab Emirates	99	12	254	$2.51B
Qatar	71	7	562	$1.62B
Nigeria	129	7	6	$1.20B
Mexico	20	20	52	$6.67B
Malaysia	24	30	374	$12.1B
Turkey	41	21	25	$2.09B
Thailand	25	37	79	$5.49B
Israel	21	37	260	$2.40B
South Korea	4	15	475	$24.6B
Singapore	5	14	$1.9k	$10.8B
China	17	28	48	$67.6B
Japan	1	3	1	$97.7M
United States of America	12	6	279	$92.5B

Source: Atlas of Economic Complexity Index

https://atlas.cid.harvard.edu/countries/122/growth-dynamics

During the period 2005-2020, Kuwait innovated four new exportable products only worth USD 1.28 Billion. By contrast, KSA innovated 19 new products, which penetrated international markets and fetched a cumulative revenue of USD 5.59 billion. Emerging economies, including Thailand and Malaysia, innovated 37 and 30 new products that helped sustain their economy and compete in international markets. The case of China is exemplary, where it invented 28 new products that fetched USD 67.7 billion (Harvard Atlas of Economic Complexity, 2023). The findings of the dynamic PVAR applied in this paper corroborate this line of policy development agenda.

5. Lessons Learnt and Implications to Kuwait

The implications of the model findings for Kuwait's prospective trajectory of growth are that it should focus on the simultaneous development of soft (human capital and industrial policies) and hard infrastructures (ports and logistics), and this section focuses more on the latter.

5.1. Developing the Soft Infrastructure

The first objective is the high-tech human capital with skills and competencies that are highly competitive and in demand in international product and labor markets. Therefore, a careful assessment of the future trajectories of these skills, along with the attraction of highly skilled and tech-abundant expat workers, is a basic element of the transformational strategy. In this regard, graduates' scholastic preps and university-imparting competencies are evidently key elements, along with the carefully designated training programs at specific firm levels that seek to upgrade and upskill workers and enhance their human capital infrastructural development.

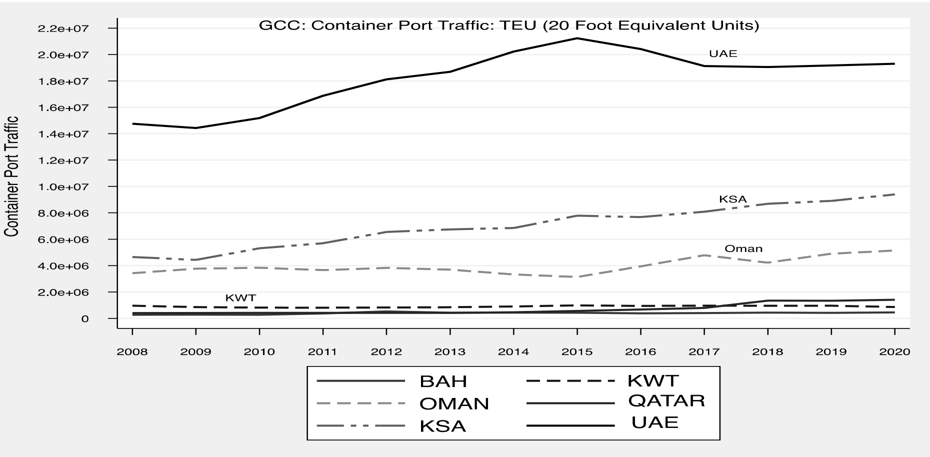
Secondly and equivalently important is the industrial and manufacturing strategy that focuses on high-tech industrial niches that specialize in producing well-studied sets of innovative exports-oriented products. The choice of manufactured and industrial products and niches should be in full congruence with the infrastructural developmental path of the high-tech skills and the temporal upgrading of human capital capabilities of Kuwaiti workers and foreign workers.

5.2. Developing the Ports Hard Infrastructure

Ports act as gateways for international trade, enabling the import and export of goods efficiently. Available literature suggests that Kuwait's main port, Shuwaikh, embed infrastructural problems, including dilapidated storage facilities, warehouses, and a deficient open storage yard. In tandem, the port experiences traffic congestion on roads surrounding Shuwaikh's port, which delays the return of empty containers to the port. These delays cause serious bottlenecks in the movement of importing and exporting goods, which reduce the port effectiveness and result in considerable losses (AlRukaibi et al., 2020).

Competition from more tech-advanced neighboring GCC ports, together with infrastructural problems of Kuwait's seaport, has caused contractions in the annual number of vessels which arrive at Shuwaikh port. As a result, Kuwait container ports' traffic ranks quite low, virtually at the bottom of the list (Figure 2).

Figure 2: GCC container port traffic, 2008–2020

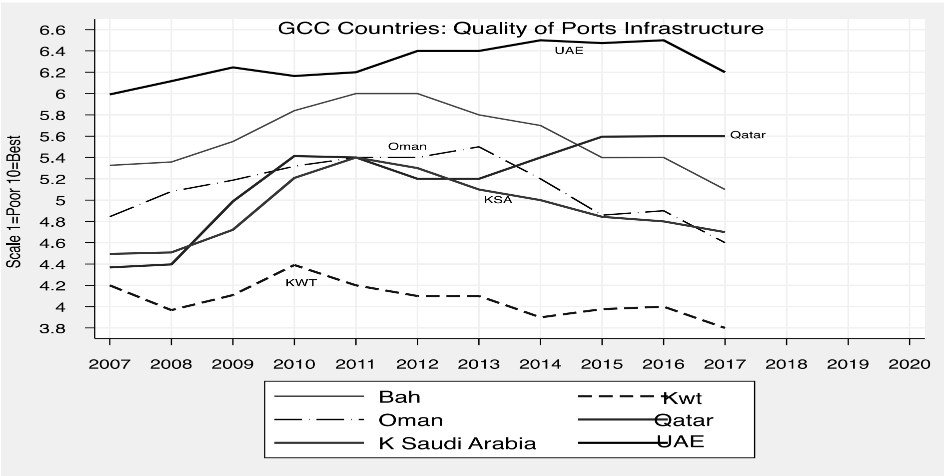


Source: http://www.worldportsource.com/countries.php

Kuwait's seaport infrastructure, cargo shipments, and container traffic are intertwined with the inhibited economic viability and volatility that arrest the diversification and penetration into international markets. Not just in terms of numbers but also the qualities, value, and revenues, as well as creating demand niches among increasing segments of consumers and users of such new and innovative Kuwaiti-specific products and services.

Seaport quality infrastructure is another key driver of the attractiveness and capacity of different ports. The indicator takes values that range between 1 (poor) and 7 (High); the lowest value of 1 indicates poor quality, while 7 indicates top quality. Deploying the indicator to Kuwait and the rest of the GCC countries yields the following time-varying seaport quality values (Figure 3), where Kuwaiti ports ranks last with declining trend over time.

Figure 3: Kuwait and GCC quality of ports over time



Source: http://www.worldportsource.com/countries.php

6. Summary and Conclusion

Econometric estimates using the panel VAR model strongly validate the hypothesis that economic growth can steadily be achieved through the infusion of innovative products and services into the international market. Trade-led growth is validated in this study with powerful inference about the flourishing economic growth role of high-technology exports in products and services. In addition, manufactured exports positively contribute to GDP growth and its time and geography differentials across countries.

These findings corroborate the hypothesis of the linkages between economic complexity indices of countries and their product diversity complexity as per the work of (Hidalgo and Hausmann, 2009; Harvard Complexity Index, 2023). Moreover, there is robust empirical evidence that the newly proposed third-level complexity of Ivanova et al. (2017) country technological complexity, gauged by patents, is an important third classification cluster that blends quite well with the Hidalgo and Hausmann economic-products complexities. That is, the empirical findings provided strong empirical evidence of causal three-way causality between economic complexities, product complexities, and technological complexities.

The variable gauging high-tech exports is Granger causing economic progression and trade complexities, and reciprocally, the feedback from domestic manufacturing diversity to trade and high-tech exports diversity are seemingly quite robust, too. These findings lend credence to the technological-economic-products complexities and diversifications. The findings show that innovative countries such as Malaysia, Thailand, China, S. Korea, and Singapore managed to penetrate into international markets and generate substantial returns for exporting products, which they innovated temporally.

Prospectively, Kuwait needs to nurture a tech-savvy human capital that is based on science, engineering, technology, and mathematics (STEM). This will, inter alia, require completely revamping the incentives and reward structures while applying meritocracy in hiring, promotion, and of ladder-advancement policies in lieu of the current system, which is seniority based. Furthermore, to ensure that the educated tech-savvy human resources are fully and gainfully employed in a temporal manner, the government, collaboratively with the private sector must design the most implementable and tractable industrial base and carefully design the most lucrative and growth-propelling innovative export products and services.

Finally, a companion analysis conducted in this paper on Kuwait's ports as contrasted to neighboring GCC ports underscored the imperatives of upgrading infrastructural capacity and quality of Kuwait's ports as complimentary requisites for the economy's long run export diversification and sustainability objectives. As indicated in the analysis, such improvements require deploying effective logistics policies and capacity building programs.

References

Abrigo MR and Love I (2016) Estimation of panel vector autoregression in Stata. *The Stata Journal* 16(3): 778-804.

Agosin MR, Alvarez R and Bravo-Ortega C (2012) Determinants of export diversification around the world: 1962–2000. *The World Economy* 35(3): 295-315.

Ajao, K., and M. O. Adenomon. 2023. "Modelling Short-run Dynamics of Macroeconomic Variables on GDP in Ecowas Countries Using Panel Vector Autoregression Model." Asian Journal of Probability and Statistics 22 (4): 1–13. https://doi.org/10.9734/ajpas/2023/v22i4488.

Al-Fulaij S, Al-Qudsi S, Arman H and Alawadhi A (2022) The Potential Role of Exports-Imports in Income Diversification and Sustainable Development of Kuwait. *Arab Journal of Administrative Sciences* 29(1).

Al-Qudsi et al. (2021) *The 2020 Coronavirus Outbreak and Global Growth and Trade Collapse: Impact on Kuwait's overall Economy and Society, its Sectors and Business Firms and Vital Fiscal Recovery Plan.* Kuwait: Kuwait Institute for Scientific Research, KISR 16534

AlRukaibi F, AlKheder S and AlMashan N (2020) Sustainable port management in Kuwait: Shuwaikh port system. *The Asian Journal of Shipping and Logistics* 36(1): 20-33.

Anderson TW and Hsiao C (1982) Formulation and estimation of dynamic models using panel data. *Journal of Econometrics* 18(1): 47-82.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-d

Arman H and Al-Qudsi S (2022) A strategic framework to analyze the East Asian miracle within triple helix model–lessons for Kuwait. *Journal of Science and Technology Policy Management*(ahead-of-print).

Asian Development Bank. 2022. "Trade Integration Deepens in Asia and the Pacific amid Pandemic," February 9. https://www.adb.org/news/trade-integration-deepens-asia-and-pacific-amid-pandemic.

Baldwin R. 2024. "Why is manufacturing-export-led growth so difficult?". Faculty Friday with Richard Baldwin @IMD, June 14, 2024

Baldwin, R., & Forslid, R. (2023). Globotics and Development: when manufacturing is jobless and services are tradeable. *World Trade Review*, *22*(3–4), 302–311. https://doi.org/10.1017/s1474745623000241

Becker SO and Egger PH (2013) Endogenous product versus process innovation and a firm's propensity to export. *Empirical Economics* 44(1): 329-354.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/s0304-4076(98)00009-8

Cadot O, Carrère C and Strauss-Kahn V (2013) Trade diversification, income, and growth: what do we know? *Journal of Economic Surveys* 27(4): 790-812.

Carrasco CA and Tovar-García ED (2021) Trade and growth in developing countries: the role of export composition, import composition and export diversification. *Economic Change and Restructuring* 54(4): 919-941.

Carter Hoffman 2024 "The double-edged sword of export-led growth". *Trade Finance Global Articles*. January 26

Chenery HB (1967) Foreign assistance and economic development. In: Anonymous *Capital Movements and Economic Development.* : Springer, 268-292.

Chudik A and Pesaran MH (2015) Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors. *Journal of Econometrics* 188(2): 393-420.

Coe DT and Helpman E (1995) International r&d spillovers. *European Economic Review* 39(5): 859-887.

De Hoyos RE and Sarafidis V (2006) Testing for cross-sectional dependence in panel-data models. *The Stata Journal* 6(4): 482-496.

Demir O (2018) Does high tech exports really matter for economic growth a panel approach for upper middle-income economies. *AJIT-E: Bilişim Teknolojileri Online Dergisi* 9(31): 43-54.

Ekananda M and Parlinggoman DJ (2017) The role of high-tech exports and of foreign direct investments (FDI) on economic growth.

Gelb A (2010) Economic diversification in resource rich countries. *Center for Global Development* 1: 23.

Goldberg, P.K. and Reed, T. (2023), Presidential Address: Demand-Side Constraints in Development. The Role of Market Size, Trade, and (In)Equality. Econometrica, 91: 1915-1950. https://doi.org/10.3982/ECTA20787

Gylfason T (1999) Exports, inflation and growth. *World Development* 27(6): 1031-1057.

Harvard Complexity Index, "The Atlas of Economic Complexity." (2023). Harvard Growth Lab. https://atlas.cid.harvard.edu/.

Hausmann, R. (2024). Harnessing global value chains for regional development: How to upgrade through regional policy, FDI, and trade: by Riccardo Crescenzi and Oliver Harman, Abingdon, UK, Routledge (2023). 120 pp., £27.99 (pbk), ISBN 9781032410760, £11.99 (ebk), ISBN 9781003356141. https://www.routledge.com/Harnessing-Global-Value-Chains-for-regional-development-How-to-upgrade/Crescenzi-Harman/p/book/9781032410760. *Regional Studies*, *58*(5), 1157–1158. https://doi.org/10.1080/00343404.2023.2291248

Hausmann R, Hwang J and Rodrik D (2007) What you export matters. *Journal of Economic Growth* 12(1): 1-25.

Helpman, E., Itskhoki, O., Muendler, M., & Redding, S. J. (2017). Trade and Inequality: From Theory to Estimation. *The Review of Economic Studies*, *84*(1), 357–405. https://doi.org/10.1093/restud/rdw025

Henning, Martin, and Rikard H Eriksson. (2020). "Labour Market Polarisation as a Localised Process: Evidence From Sweden." *Cambridge Journal of Regions, Economy and Society* 14 (1): 69–91. https://doi.org/10.1093/cjres/rsaa030.

Henry M, Kneller R and Milner C (2009) Trade, technology transfer and national efficiency in developing countries. *European Economic Review* 53(2): 237-254.

Herzer D, Nowak-Lehmann D F and Siliverstovs B (2006) Export-led growth in Chile: Assessing the role of export composition in productivity growth. *The Developing Economies* 44(3): 306-328.

Hesse H (2009) Export diversification and economic growth. *Breaking into New Markets: Emerging Lessons for Export Diversification* 2009: 55-80.

Hidalgo CA and Hausmann R (2009) The building blocks of economic complexity. *Proceedings of the National Academy of Sciences* 106(26): 10570-10575.

Hijzen, A., Martins, P. S., Schank, T., & Upward, R. (2013). Foreign-owned firms around the world: A comparative analysis of wages and employment at the micro-level. European Economic Review, 60, 170-188.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica*, *56*(6), 1371. https://doi.org/10.2307/1913103

Huria A and Brenton P (2015) Export Diversification in Africa.

Hvidt M. (2013) "Economic Diversification in GCC Countries: Past Record and Future Trends". The London School of Economics and Political Science, Kuwait Programme on Development, Governance and Globalisation in the Gulf States (Research Paper No. 27)).

Imbs J and Wacziarg R (2003) Stages of diversification. *American Economic Review* 93(1): 63-86.

IMF (2014) Sustaining Long-Run Growth and Macroeconomic Stability in Low-Income Countries—The Role of Structural Transformation and Diversification. *IMF Policy Paper*.

Ivanova I, Strand Ø, Kushnir D and Leydesdorff L (2017) Economic and technological complexity: A model study of indicators of knowledge-based innovation systems. *Technological Forecasting and Social Change* 120: 77-89.

Judson RA and Owen AL (1999) Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters* 65(1): 9-15.

Kabaklarli, E., Duran, M. S., & Üçler, Y. T. (2018). High-technology Exports and Economic Growth: Panel Data Analysis for Selected OECD countriesHigh-technology Exports and Economic Growth: Panel Data Analysis for Selected OECD Countries. *Forum Scientiae Oeconomia*, 47–60. https://doi.org/10.23762/fso_vol6no2_18_4

Kalaitzi, A., Al-Awadhi, A., Al-Qudsi, S. and Chamberlain, T.W., 2023. Export diversification and economic growth in Kuwait: evidence from time series and field survey analyses.

Kalaitzi AS and Cleeve E (2018) Export-led growth in the UAE: multivariate causality between primary exports, manufactured exports and economic growth. *Eurasian Business Review* 8(3): 341-365.

Keller W (2000) Do trade patterns and technology flows affect productivity growth? *The World Bank Economic Review* 14(1): 17-47.

Lederman D and Maloney WF (2006) *Natural Resources, neither Curse nor Destiny.* : World Bank Publications.

Mazzi, C. T., & Foster-McGregor, N. (2021) Imported intermediates, technological capabilities and exports: Evidence from Brazilian firm-level data. *Research Policy* 50(1): 104141.

McKinnon RI (1964) Foreign exchange constraints in economic development and efficient aid allocation. *The Economic Journal* 74(294): 388-409.

Melitz MJ (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica* 71(6): 1695-1725.

Mesquita Moreira M, Blyde J, Volpe C and Molina D (2013) Too Far to Export: Domestic transport costs and regional export disparities in latin america and the caribbean.

Mishrif A. 2018. "Introduction to Economic Diversification in the GCC Region" In *Economic Diversification in the Gulf Region,* Volume I (pp.1-26) December 2018 DOI:10.1007/978-981-10-5783-0_1.

Nickell S (1981) Biases in dynamic models with fixed effects. *Econometrica: Journal of the Econometric Society*: 1417-1426.

OECD and World Trade Organization (2019) *Aid for Trade at a Glance 2019.*

OECD (2024), *Revitalising Services Trade for Global Growth: Evidence from Ten Years of Monitoring Services Trade Policies through the OECD STRI*, OECD Publishing, Paris, https://doi.org/10.1787/3cc371ac-en.

Özsoy, S., Ergüzel, O. Ş., Ersoy, A. Y., & Saygılı, M. (2021). The impact of digitalization on export of high technology products: A panel data approach*. *Journal of International Trade & Economic Development*, *31*(2), 277–298. https://doi.org/10.1080/09638199.2021.1965645

Pesaran MH (2021) General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics* 60(1): 13-50.

Rodil Ó, Vence X and del Carmen Sánchez M (2016) The relationship between innovation and export behaviour: The case of Galician firms. *Technological Forecasting and Social Change* 113: 248-265.

Rodrik D. 2023 "A Comment on Presidential address: Demand side constraints in development: The role of market size, trade, and inequality" by P. Kouhianou Goldberg and T. Reed" *Econometrica* Vol 91 No (6) 2023 November).

Shadab, Saima. 2023. "The New Arab Gulf: Evaluating the Success of Economic Diversification in the UAE." In Gulf Studies, 415–30. doi:10.1007/978-981-19-7796-1_25.

Sheridan BJ (2014) Manufacturing exports and growth: When is a developing country ready to transition from primary exports to manufacturing exports? *Journal of Macroeconomics* 42: 1-13.

Siswana S and Phiri A (2021) Is export diversification or export specialization responsible for economic growth in BRICS countries? *The International Trade Journal* 35(3): 243-261.

UNCTAD (2018) *Exports Diversification and Employment in Africa.* Geneva: UNCTAD.

Van Beveren I and Vandenbussche H (2010) Product and process innovation and firms' decision to export. *Journal of Economic Policy Reform* 13(1): 3-24.

Appendix –Testing that panels are homoscedastic or free of dependence of cross-sectional errors

1. Kao's Cointegration Tests

xtcointtest kao lngdp15 lnmanufval15 lnhightechexpl1 lnimports15 lnfdiinl1 lnhightechexp if id<58,
Kao test for cointegration

Ho: No co-integration Number of panels = 46
Ha: All panels are cointegrated Avg. number of periods = 19.413
Cointegrating vector: Same
Panel means: Included Kernel: Bartlett
Time trend: Not included Lags: 1.77 (Newey-West)
AR parameter: Same Augmented lags: 1

Table A.1: Kao's Cointegration Tests

	Statistic	**p-value**
Modified Dickey-Fuller 1	-0.126	0.450
Dickey-Fuller t	-1.351	0.088
Augmented Dickey-Fuller 1	1.265	0.103
Unadjusted Modified Dickey-Fuller t	0.135	0.446
Unadjusted Dickey-Fuller t	-1.169	0.121

2. Test of Cross-Sectional Dependence

xtreg lngdp15 l2.hightechpct lnpoptot l1.lnexports15 l1.lnimports15 l1.lndebttogdp lnfdiinfmusd l2.investtogdp , fe

Fixed-effects (within) regression Number of obs = 935
Group variable: id Number of groups = 46

R-sq: Obs per group:
within = 0.9049 min = 1
between = 0.7251 avg = 20.3
overall = 0.7029 max = 27
F(7,882) = 1198.63
corr(u_i, Xb) = -0.3375 Prob > F = 0.0000

Table A.2: Test of Cross-Sectional Dependence

Ingdp15	Coef.	Std. Err.	T	P>[t]	[95% Conf. Interval]	
1.2 hightechpct	0.001	0.001	2.130	0.033	0.000	0.003
Inpoptot	0.922	0.035	26.510	0.000	0.854	0.990
L1. Inexports 15	0.184	0.016	11.340	0.000	0.152	0.215
L1 Inimports 15	0.118	0.017	6.810	0.000	0.084	0.152
L1.Indebttogdp	-0.068	0.007	-9.340	0.000	-0.083	-0.054
Infdiinfmusd	0.013	0.002	5.460	0.000	0.008	0.018
L2.investtogdp	-0.003	0.001	-3.320	0.001	-0.004	-0.001
_cons	-6.470	0.553	-11.710	0.000	-7.555	-5.386
Sigma_u	0.929					
Sigma_e	0.077					
rho	0.993 (fraction of variance due to U_i					

3. Cross-Sectional Dependence Exponent Estimation and Test

(xtcse2 lngdp15 l2.hightechpct lnpoptot l1.lnexports15 l1.lnimports15 l1.lndebttogdp lnfdiinfmusd l2.investtogdp)

Panel Variable (i): id Time Variable (t): year

Table A.3: Cross-Sectional Dependence Exponent Estimation and Test

Variable	Alpha	Std. Err.	[95% Conf. Interval]	
Ingdp1 5	1.003	0.216	0.579	1.427
L2.highechpct	0.971	0.240	0.501	1.442
Inpoptot	0.998	0.126	0.751	1.245
L.Inexports 1 5	1.003	0.130	0.748	1.258
L.Inimports1 5	0.995	0.143	0.715	1.275
L.Indettogdp	0.782	0.064	0.658	0.907
Infdiinfmusd	1.004	0.082	0.844	1.165
L2.investtogdp	0.701	0.091	0.524	0.879

0.5<=alpha <1 implies strong cross-sectional dependence.

4. Pesaran (2015) Test for Weak Cross-Sectional Dependence

H0: errors are weakly cross-sectional dependent.

Table A.4. Pesaran (2015) Test for Weak Cross-Sectional Dependence

Variable	CD	p-value	N_g	T
Ingdp1 5	181.571	0	40	50
L2.highechpct	74.907	0	16	13
Inpoptot	21.381	0	49	51
L.Inexports 1 5	159.926	0	35	49
L.Inimports1 5	160.305	0	35	49
L.Indettogdp	62.913	0	14	46
Infdiinfmusd	124.389	0	17	40
L2.investtogdp	144.087	0	36	33